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LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

VOL. CLVII. No. 3061.] LONDON, JANUARY 11, 1922. [74TH YEAR. PRICE 1s.

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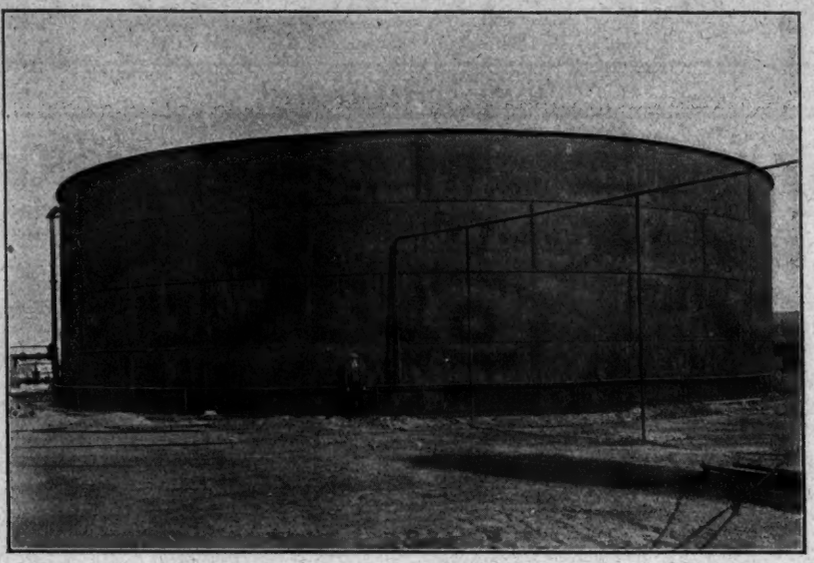

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VOL. CLVII., No. 3061.] WEDNESDAY, JANUARY 11, 1922. [74TH YEAR.

EDITORIAL NOTES.

Professor Bone's Fresh Attack.

"THE TIMES" correspondence columns were alive last week over the question of carbon monoxide in town's gas. The revival of the matter has been caused by "W. A. B.'s" article in "Nature," which our morning contemporary acquiesced in through editorial comment, obviously without the necessary scientific knowledge and the lessons of practical experience to guide it. Dr. Carpenter, as Chairman of the Gas Companies' Protection Association [see *ante*, p. 20], followed this up for the gas industry. This gave Prof. Bone an opportunity which he was not slow to take with a letter which, in one part, is nothing less than a veiled attack on the competence of the Board of Trade and their experts to deal with the question. To say the least, this does not evince diplomatic skill or tact on the part of a person who desires that Parliament itself shall put upon the gas industry a statutory limitation of carbon monoxide, seeing that it was Parliament who, mainly through the former activities of Prof. Bone, decided that the Board of Trade should set up a Committee to inquire into the subject, and should act on the Committee's decision. This has been done; but the decision does not please Prof. Bone. "If the public," he now writes, "wants to be protected "from the admitted dangers inherent in a high percentage "of carbon monoxide in domestic gas supplies, it must not "trust either to the Board of Trade or to its new experts, "but should insist upon Parliament itself enacting a reason- "able statutory limitation thereof." As Mr. D. Milne Watson and Dr. Carpenter have shown in the correspondence, the Board of Trade has in this matter recourse to ample expert assistance. It has the Board of Fuel Research at hand; it has the Gas Referees; and it has had a thorough investigation by a Committee of four, whose painstaking and judicial inquiry was the admiration of everyone—other than possibly one or two of the would-be restrictionists.

Before that Committee Dr. Haldane appeared. He is one of the Gas Referees; and well known is his prepossession regarding limitation—prepossession born of scientific knowledge of the toxic property of carbon monoxide, rather than of that large practical daily experience which should (though unfortunately for the world it does not always) qualify even the views of distinguished scientific men. Though Dr. Haldane in a letter to "The Times" denies that the functions of the Referees extend to the question of giving advice to the Board of Trade on the subject of carbon monoxide, we agree with Dr. Carpenter that it would indeed be unfortunate if we were not to regard the Referees as the scientific advisers of the Board on gas matters. At any rate, it is a satisfaction that the Gas Regulation Act provides that "at least two of the Gas Referees "shall concur in every act or determination of the Gas "Referees." The gas industry, too, has a right to look for the utmost impartiality from every Referee on all questions affecting its interests. No objection was raised to Dr. Haldane, although a Referee, giving evidence before the Board of Trade Committee dealing with the question of carbon monoxide. But having given that evidence, there, so far as Dr. Haldane was concerned, being a Referee, the matter should have been allowed to remain. Now, however, he has publicly made what appears to us to be a reflection (courteously put) upon the decision of the Committee which cannot be justified by anyone who, with unbiassed mind, reads their report and conclusions, and pays due regard to the relation of one part to another. No one sentence of the report can be taken alone without including consideration of all else that is said. But here we have one of the Gas Referees, referring to the principal decision that "it is not necessary or desirable to prescribe "any limitation of the proportion of carbon monoxide which "may be supplied in gas used for domestic purposes," saying "the decision as to what is reasonably safe as regards "the poisonous properties of lighting gas is thus left to the "directors of gas undertakings." That is not true, unless "directors" embraces engineering and chemical officials. Then Dr. Haldane adds: "In my opinion, this is a far "more serious responsibility than the Committee realized." These are the words in his letter to which we take the strongest possible exception—coming from a Gas Referee, and dealing with a decision of a Committee appointed under the same Act as the Referees. We cannot regard the last quoted statement in any other light than as a reflection upon the competence and capacity of the Committee for the task entrusted to them, though not impugning their *bona fides*. We cannot think the tactics employed by the solitary protagonists of carbon monoxide limitation are likely to succeed in their object.

Let us return to Prof. Bone. He liberally attacks the quality of gas and the pressure—both matters that have been dealt with in the Gas Regulation Act. Less than two years ago, sale by the therm actually had his blessing as a sensible thing. Pressure has also had a satisfactory minimum attached to it by Parliament. But changes in huge systems of gas production and distribution cannot be effected with the ease experienced by a professor in his laboratory. The position of the gas industry in the matter of fuel economy and its future correlation with electric power and smokeless fuel schemes—matters which the Fuel Research Board has in hand—should, Professor Bone urges, be now reviewed. He appears to have become strongly attached to solid smokeless fuel in latter days; and the reason is not altogether plain. The gas industry, according to him, has been allowed to continue too long in its old ruts, to the detriment both of its own interests and those of the community it serves. Prof. Bone strikes us as a man who is in a violent hurry. The Gas Regulation Act was designed for the express purpose of giving the industry an opportunity for getting out of the old ruts in which Parliament, bound by tradition and precedent, kept it all too long. Practical considerations ought to suggest, and do suggest to most people, that the industry must have time to move from one state to the development that the Gas Regulation Act gives it freedom to make. This all shows, however distinguished a man may be as a scientist, how out of harmony he may be with practical methods of progress. So Prof. Bone wants a strong and disinterested Public Commission to consider these matters; and he urges that parliamentary candidates should be asked to pledge their support for an inquiry into a matter vitally affecting both public health and domestic economy.

So far as carbon monoxide is concerned, we have had inquiry by men disinterested, and representative of the public, of science, and of the gas industry, with which only one of the four members was identified. Everyone, however, who has taken part in "The Times" correspondence has omitted to notice the suggestion of the Committee "that the "Departments concerned should carefully watch the situa- "tion, so that, if the freedom from limitation which we re- "commend is accompanied by unexpectedly unfavourable "results, the attention of Parliament may, if necessary, be "again directed to the matter." There we have ample protection for the public after the scrupulously fair inquiry that was made—not by scientists with prepossession, but by men who could consider the matter scientifically and weigh up the risk against the facts of actual experience. When

that little deputation from the Fuel Economy Committee of the British Association (which deputation was headed by Prof. Bone) went to the Board of Trade in February, 1920, and urged that various impossible restrictions should be placed upon the gas industry, which would have damned its economic development and service to the community, we invited them to consider certain figures [see "JOURNAL," Feb. 10, 1920, p. 290] as to increase of consumption of gas, increase of consumers, and so forth, during the period of the enlargement of the use of water gas, and asked the advocates of carbon monoxide restriction to explore these facts in relation to risk. But never once during all the controversy has Prof. Bone approached the subject from the bases supplied by the figures. Why is this? Is it because he knows that the results of such an examination would be against him and his hypothesis? Parliament cannot legislate on scientific fancy and obsession; it must consider the facts presented by practical experience and expansion. That is how the recent Departmental Committee regarded the matter. Looking back at the deputation to the Board of Trade and over the history of all that has followed, Prof. Bone's present position reminds us very much of those labour leaders who (in the past) have accepted arbitration in respect of matters in dispute, and then, if the decision does not square with their demands, repudiated it, and advised non-acceptance by the rank-and-file. We are afraid that Prof. Bone will never be contented over this matter until (which we hope will never be the case) scientific dogmatism prevails over practical experience—practical experience that is assessed by practical facts.

One point more. Though it was the Fuel Economy Committee of the British Association who started this particular ball rolling at the Board of Trade under the leadership of Prof. Bone, the only members of the Committee qualified to express an opinion upon the subject, had the following footnote appended to the last report of that body: "Three "members of the Committee—Messrs. E. V. Evans, D. H. "Helps, and H. James Yates—were, however, of the opinion "that, in view of the provisions of the Gas Regulation Act, "1920, for the future sale of gas on a thermal basis, gas "undertakings should be allowed a free hand in regard to "carbon monoxide and inerts." Thus Prof. Bone has not the unanimous support of the Fuel Economy Committee of the British Association in his new campaign for imposing fresh restrictions on the gas industry. The plain fact is that despite inquiry as ordered by Parliament, despite the fact that talented men have advised the Board of Trade on the subject, nothing will please Prof. Bone in respect of this particular matter save the consummation of his own views, untested and unaffected by practical experience applied from a rational basis.

Controlling from Newcastle Coal Carbonization in London.

IF all industries brought their standards of scientific control up to rational levels, we should be a wealthier nation, for that control would annul many conditions that distribute uneconomy throughout the country. The inter-relation of industries is a material fact that is all too frequently ignored with a lofty disdain of the consequences. This is a pity, but it exists, with wasteful and therefore disastrous results. The Federation of British Industries might add to their services to the country by preaching the gospel of the inter-relation of industries, and the responsibility to national economy and prosperity of the leaders of each industry. Illustrative of inter-relation is the paper that Mr. G. M. Gill, the Chief Engineer of the South Metropolitan Gas Company, read last Friday at a joint meeting of the Institution of Mechanical Engineers and the Society of Chemical Industry. Mr. Gill was a critic particularly of the coal and the refractory materials industries; but when he is a critic, he rarely (if ever) overlooks the fact that, where possible, the criticism should be accompanied by constructive suggestion. It was so on this occasion.

We all appreciate in a general way, even though no exact appraisement can be made, that the variations there are in the qualities of raw material used for manufacturing or constructional purposes have a large effect on the efficiency of plant and processes, and add to the difficulties of producing uniformity in quality and quantity of output. The further uniformity recedes from the best standards, the greater the loss; and the losses in one industry in this respect react upon other industries drawing supplies from it. This is all elementary in the science of economics; but, elementary though it be, it is much neglected. The coal industry is in this respect a persistent sinner. Coal properly takes foremost place in Mr. Gill's illustration. Not only does the quantity of inert material vary, but the coal from the same colliery may differ considerably in its physical and chemical conditions, and therefore in its value for gas-making purposes. It may, for example, show a difference in volatile matter lying between 24 and 34 p.ct., which is serious from the gas maker's point of view, if he has paid for, and hoped to get, the better quality of coal. Coal is usually bought under a purely nominal description. It ought not to be. The differences in the quality of coal submitted for purchase under one name are so great that the gas and bye-product making results will and do vary considerably, and the regulation of plant and processes cannot be varied so promptly with deliveries that the best efficiencies can be achieved at all times and in all circumstances. This qualitative unreliability of coal supplies and the effect it has on manufacturing operations, have led to a fresh innovation on the part of the South Metropolitan Gas Company.

Consistent and efficient control from the beginning of manufacture to the point of utilization is a practice of the Company which can be admired, if impossible of emulation by all gas undertakings. Mr. Gill now tells us how the carbonizing operations in London are partially governed by information from Newcastle. That is rather a remarkable state of affairs; but it is an extension of the Company's practices due to the unreliability of the quality of coal purchased. The scheme is in its infancy; but better operating results are anticipated from it. The proof of substantial benefit has yet to be made. What the Company have done is this: They have established a fully equipped laboratory with the necessary staff at Newcastle. The coal purchased is sampled as it is unloaded into their ships. After this the samples are analyzed. All coal above a definite size is hand-picked, and freed from dirt. The results are telegraphed to London in time to give those responsible for the operation of the works an opportunity of regulating the carbonizing plant to suit the varying grades of coal before their actual arrival. It will be interesting to learn what actually happens from this piece of new enterprise. Of course, this could not be done by undertakings of much less magnitude, except by joint arrangement. If all buyers of coal for gas-making purposes did the same thing, a regular colony of testing-stations would spring-up. Moreover, many works buy coal from different coal-fields; and they could not afford to have independent testing places in each field from which they purchased. To the works themselves coals purchased of various qualitative descriptions from different areas and even from the same collieries, come daily; and it would be almost impossible to arrange for such nicety of regulation of the carbonizing conditions that each variety gave its maximum results. There has to be more or less of a compromise. We are afraid that for most gas-works the old custom (where it is practised, for there is great neglect of fundamental information by analyses as to the quality of coal) will be continued; and the new practice of the South Metropolitan Company will have comparatively few followers. However much admired for its enterprise, it will for the majority of undertakings have to cease there, other than possibly by co-operation.

The work that the South Metropolitan laboratory at Newcastle does should in the main really be carried out by the collieries themselves. Gas undertakings sell their primary product by quality; and why should not the coal industry? Mr. Gill suggests—and there will be general agreement—that the time has arrived when each colliery should grade or classify the coals from various pits and seams, keeping each grade of the same quality within the narrowest practicable limits. There is no question that the advantages to users of such a step would be great, and would react favourably upon the whole coal industry. To gas undertakings it would certainly be a boon; for it would result in more uniform and higher yields of every product in which they are concerned. The colliery owners have lately shown a disposition to assert their right to have coal forked instead of shovelled, in order that the quality of coal supplied to their customers may be improved; but we are afraid users will have a lot of tough work before them should they attempt to educate colliery owners up to belief in, and practice of, continuous sampling of coal and testing both physically and chemically with the view to its standardization and classification. It is undoubt-

edly what should be done in the national interests; but it is, we feel, something that will not be done—at any rate, for a long time ahead, during which waste will continue. If it were done, it would be another means of extending that collaboration between chemists and engineers which is, wherever it is the rule, to the material advantage of industry, and therefore to the country.

Variations in Refractory Materials.

THE manufacturers of refractory materials are taking a large part in the work of investigation which is being carried on with the view to the improvement of their productions. The importance of such improvement cannot be gainsaid, in view of the severity of the temperature and other conditions which their productions have to meet, and the costliness to the users of the initial, upkeep, and renewal expenditure. We do not think Mr. Gill, in the paper referred to in the previous article, gave the manufacturers sufficient credit for this participation in research. He looked at the results of their productions; and, in his opinion, there is plenty of evidence in them that the teachings of investigation are not being generally applied in the manufacturers' works. The criticism may be justified in certain instances; but there is no question that there is healthier control in some works than in others. Credit for moving in improvement upon past practices ought not to be withheld. But there is indication in Mr. Gill's paper that he is of opinion that the old custom of working by judgment in respect of mixing, drying, and firing, rather than by scientific control aided by instruments, is such an indurated habit that it actually persists as a general feature of the refractories industries. He speaks of users hunting the country for what they require in material reliable in quality and durability, and (what is also important) in size; and he hints that, if British makers do not bestir themselves, the home demand will be transferred to abroad.

At the same time, there is sympathy with Mr. Gill in what he says. He speaks from experience, and not imagination, when he asserts that one of the most unsatisfactory features with which users of refractories have to contend is the variation in qualities and sizes of bricks, blocks, and retorts. These conditions mean that all sorts of problems have to be faced owing to want of uniformity in this respect. To illustrate his point, he supplies actual differences in internal sectional measurements of retorts, which cause sections to be under-sized or over-sized. Irregularities of this kind must, of course, have a very bad effect upon discharging operations. Where there are such discrepancies in shape and size, inconsistency of material and bad workmanship are also found. The latter are partly the causes of the misfits. Where this sort of thing obtains, there waste and uneconomy result, which could be avoided if rational methods were employed in company with scientific control. Mr. Gill shows what, in his opinion, should be provided for; and he indicates his view that in refractories better quality is more important than price. There are refractory manufacturers who will agree, with the qualification that gas undertakings hold the purse-strings, and will not pay the price. But what of those who would, in order to get what they want? The South Metropolitan Company would do so; but why is it that, being willing, they cannot consistently get what they require? Perhaps the manufacturers will supply the answer. There is the complaint, with Mr. Gill's authority and experience behind it. We cannot assert that he is wrong; and yet we are unwilling to think that the leading manufacturers of refractory material in this country have not taken advantage of the lessons supplied by the scientific work that has been proceeding.

There is more of interest in Mr. Gill's paper—part of it supplementing the recent valuable contribution to the proceedings of the Institution of Gas Engineers. But it is all prepared and written with the view of illustrating how industries are dependent the one upon the other in the matter of high standards of efficiency in their several operations.

Gas Consumers Criticize Gas Suppliers' Methods.

IT is not disputed that there are gas undertakings with incompetence and old-fashioned and wasteful methods at the gas sales end. There is cause for good knowledge of the fact; but we protest very strongly against influential newspapers publishing information under headlines which (combined) suggest that what is bad and indifferent is common to the whole. It is far from being so. The "Pall Mall "Gazette" has opened its columns to criticism of gas companies' methods. It was started by a correspondent who fancies he has found one reason why gas is dear compared with pre-war times. But gas, generally speaking, is not dear, when considered in relation to the actual costs or relatively to other commodities. But, in the opinion of this correspondent, what helps to make it dear is the red tape, and the army of officials, inspectors, and workmen that the gas company employ through whom he has had the experience he relates. If his tale is all true (it has the appearance of being highly coloured), his strictures are partly justified; and admittedly the kind of thing he describes is enough to give dissatisfaction to the most amiable of persons. A screw in a gas-tap was loose. He complained to a meter reader. The complaint caused him, according to the narrative, to receive two or three visits from inspectors, and at least a couple from two workmen and their boys. This suggests waste. If true, it shows that the methods of the Company in this case were defective, and therefore wasteful. There is, however, another side to the question. It was the consumer himself who actually initiated the waste, because apparently he was not competent to tighten a gas-tap screw. The incident also shows something else—that the company were desirous to remedy the complaint, and to ensure by inspection that satisfaction was given to the consumer. This aspect of the matter the grumbler overlooks. It is the incompetent householder, who cannot adjust even the smallest thing in connection with his gas-fittings, who necessitates at all events some part of the staff of the distribution department of a gas undertaking. But a more singular complaint of the same correspondent is what he chooses to regard as the waste of gas in the showrooms of gas undertakings. If he considers the point, and follows it to its logical conclusion, he will see that it is really against him. A gas company must in their showrooms demonstrate the value of gas-consuming appliances. It shows good enterprise. Without demonstration, less business will be done. The enterprise that illustrates how gas should be used is one of the best means of expanding business; and expansion of business is one excellent way of reducing costs, and cheapening price to the consumers.

Another correspondent endorses the complaint as to the extravagant methods of gas companies in their distribution and sales work. But this gentleman has an axe to grind; and in the grinding he slanders gas suppliers in bulk, and without any qualification. The absurdity of his point is obvious in these days of competition, and of the free exercise of the will of householders in adopting what they themselves conceive to be, or have knowledge of as being, the most economical means of cooking. Gas suppliers know full well that one of the strongest contributors to business stability is to promote the economical use of their prime commodity. That is a strong point in the policy of all progressive gas undertakings. But this correspondent tries to persuade that section of the public which reads his effusion that, on the contrary, their policy is to favour gas-cooking stoves that are shamelessly "gas-wasting "machines." This accuser is an inventor. He alleges that he has designed a gas-cooking stove that will save 30 to 40 p.ct. of the gas ordinarily used. If he can satisfy gas companies that this is so, they will welcome it. He asserts, however, that he has tried to get the invention taken up; but the companies will not have it. Perhaps the companies have some good reason which is not explained by the inventor himself. We cannot tell, because it is not known what invention is referred to. He declares that the manager of one gas-stove company told him that the trade made 90 p.ct. of their profits from supplying their wares to gas companies; and "they did not want to offend their best "customers." We should like to know the name of that manager, because the assertion is too ridiculous for comment. The responsible officials of progressive gas undertakings want nothing but the most economical gas appliances, for they know the business stabilizing and advertising value of economy in the use of gas. At all events we are glad that the manager who made such a silly statement was not a gas manager.

However, here we have two definite complaints—one of internal uneconomy, and the other of fostering uneconomy to the disadvantage of the consumers. As general charges we deliberately assert that they are both grossly unfair. Where methods in the distribution department are bad now,

they were bad before the war, when the price of gas was much lower, so that the impeached methods of dealing with consumers' complaints and repairs are not the cause of the price of gas being "dear"—"high" relatively to pre-war charges would be a better term. Where, however, consumers' criticism of uneconomy in organization, policy, and methods in the distribution or gas sales department is justified, it may do good; but to judge gas suppliers *in toto* by the shortcomings of the few, is unjust. The same thing could be done in every walk of life. Those who have been airing their grievances in the "Pall Mall Gazette" would not care to be classified with those of the human species of a lower standard in rectitude and morality. However, where there is room for improvement in the methods of gas undertakings in dealing with their customers, it may result from consumers' criticisms. Fair criticism is welcomed. But there should always be discrimination, and not wholesale condemnation.

Professor Boys and Gas Coke.

We are indebted this week to Prof. Boys, F.R.S.—one of the Gas Referees—for the account printed on a later page of his long personal experience in the use of gas coke for heating the rooms of his house. It will be seen that he will not use coal, and strongly prefers gas coke. He burns it without any special devices, and without any difficulty. His satisfaction with it is complete; and he finds it has several advantages over coal—one of which is, apart from the good heating duty obtained, that he has had no need for the services of a chimney sweep for eight years. He explains his simple methods of using the coke. The whole testimony is good—particularly coming from Prof. Boys.

Gas Pressure and the Regulation Act.

In our "Correspondence" columns to-day, Mr. A. Cunnington, the Lighting Engineer and Superintendent of the London and South-Western Railway, calls attention to the facts that, while Mr. W. J. Sandeman, in his recent paper before the Illuminating Engineering Society, asserted that a pressure of 25-10ths to 30-10ths was needed to secure a mantle really full of flame, the gas industry through the past two years resisted the pressure demands of the railway companies, which the "JOURNAL" described as unreasonable. Mr. Cunnington must have regard to practicability as well as to necessity to ensure a fully flame-fed mantle in all places and in all circumstances. A "minimum" pressure is what has been legislated for, and that minimum is 2 inches, which is not far from the 25-10ths that is Mr. Sandeman's lower figure. To obtain that 2 inches at the uttermost parts of the area, the initial pressure at the works must start at considerably higher than 2 in.; so it follows that the bulk of the consumers will get, at the inlet of their meters, the pressure that Mr. Sandeman advocates. To obtain this pressure at all parts of an area would require a material raising of the initial pressure at the works; and if 2 in. minimum can be secured at the farthest parts of a supply area (where the consumption as a rule is relatively small through the less density of the population), the difference in illumination that would be obtained by increasing the minimum pressure to 2½ or 3 in. would not warrant the expenditure that would have to be incurred on boosting plant or the enlargement of the mains. The question has to be viewed from more angles than one; and expediency and economy must count. Very frequently, it is the consumer's own internal piping, and not the gas suppliers' pressure, that deprives him of the realization of good efficiency.

Tully Gas Developments.

An interesting letter full of confidence as to the future has been received from Mr. C. B. Tully. We give it in our "Correspondence" columns to-day, as it indicates developments now taking place and in store in connection with the system to which our correspondent's name is attached. In the history of the enlargement of therm production per ton of material handled, Mr. Tully's work and system will always have an honoured place, in company with other plant and processes which have multiplied the methods of coal treatment from the one-time universal practice of carbonizing in horizontal retorts.

Government Delays in Granting Loans.

An "Evening Standard" representative the other day had an interview with Sir Arthur Duckham on the subject of the revival of trade. It is coming gradually, but there must be hard work for all. That is Sir Arthur's view. In the latter part of the statement, there is a remark which reminds of the last meeting of the Society of British Gas Industries, when complaint was made of the delay of Government Departments in sanctioning loans for new work, which prolongs unemployment, and holds back industry. Sir Arthur said contractors should have their task made as easy as possible by the quick co-operation of the Ministry of Health. "We have had in hand for the last six months an order for public work, which cannot be started because Government sanction has not yet been granted; and until it gives the word, these people cannot go ahead. It amounts in money to between £40,000 and £50,000—a comparatively small sum—but one which is duplicated many times probably by similar delay in other cases."

An Eaton Investment Bond.

An esteemed correspondent has sent us a circular card issued by Mr. R. C. Eaton. He was under the impression that the name had some identity with that of an erstwhile promoter of small gas companies with big names and capitals of equal calibre. Of course, the Eaton who was attempting to flourish fifteen or sixteen years ago by endeavouring to get the public to invest in those overweighted gas concerns had a christian name beginning with "E." "R. C. Eaton" is inviting people who do not like the depreciation in the market value of securities and the present outlook, nor the heavy income-tax, to pay an annual deposit for ten years or up to previous death of a given amount—say, £200. An investment insurance policy is issued. On the deposits paid, 3 p.ct. is guaranteed; and as the Government allows income-tax rebates on insurance payments, 6s. on £200 represents a goodly sum, which is regarded as profit, as it has not to be paid out of pocket in income-tax. So by the cash payments, the 3 p.ct. interest, and the income-tax that is not paid, added together on paper a substantial sum is represented at the end of ten years. We are not indulging in this form of investment; and it is not our opinion that Mr. R. C. Eaton will find many clients in the gas industry.

Synthetic Coal.

Synthetic coal is something that has been heard of for some years. In 1918 we announced the formation of a Company for exploiting a substance under that name, and do not remember having heard of the concern since. Now the "Daily Chronicle" announces a "startling" claim by a Bavarian chemist, who has found a new way of making synthetic coal. When we read what follows we see nothing "startling" about it. It is described as a "discovery." "Synthetic" has something attractive about it. "Synthetic coal" sounds better than a briquette, for example. However, we should want to know more as to the details, and have an analysis of the stuff, before deciding whether to describe it as a discovery. The material has a heating value of only 8000 B.Th.U.—we suppose per pound. The tale goes on to inform the reader that the new synthetic coal produces gas "at least equal to that obtained from the best gas coal." We should like to know whether this means in quantity or quality, because a material of a value of only 8000 B.Th.U. could not produce quantitatively or qualitatively what a 14,500 B.Th.U. coal could do. Further, it is stated that the cost of the material is only about half the price of ordinary coal at the present time. Therefore, if the price of coal slips down, away goes any advantage which the synthetic coal may possess, but which advantage the "Chronicle" report does not enable us to detect.

Railway Rates.

There is a growing feeling in industrial circles that the railway companies have not gone so far as they might and could have done in reducing the cost of conveying coal and coke and iron and steel. Some eminent industrial leaders are interesting themselves in the matter; and additional and influential pressure will no doubt be brought upon the railway companies. Of course, every little helps; but it is felt that the recent concessions will not go far to assist in retrieving the fortunes of the country.

Gas Coal Position.

The erratic atmospheric temperatures have caused the demand for gas to make rapid changes, especially for heating purposes; and this naturally has its influence on the open market purchase of coal by gas undertakings. Market reports generally state that, while the position of gas coal is steady, the year has opened with a falling-off in demand. This might have been expected in view of the heavier buying there was before the holidays, and the fact that, these being over, supplies have now better security. With lower prices operating, too, it may be expected that coal in store will be more largely drawn upon, in order to stock-up again at more reasonable prices when the winter season is over. There are signs that gas undertakings are contracting more freely, and for increased quantities on last year's figures. Another movement has already become perceptible. The reduction of railway rates has induced some gas undertakings to go further afield for their coal supplies, in order to get better qualities than could be obtained from the nearer collieries from which they have been drawing their requirements in order to save railway carriage.

ELECTRICITY SUPPLY MEMORANDA.

ELECTRICITY, we are asked to believe, possesses some peculiar properties that other heating agents have not. Heat is heat; the differences there may be are only in respect of the facilities of application. Mr. J. W. Beauchamp, the

Peculiar Heating Properties.

explorer of the ways and means of electrical development, has incidentally called attention to the matter; and "Electrical Industries" has expended upon it rather more than a whole column of editorial matter. Mr. Beauchamp deals with the question from the physiological point of view. Human beings are continually dissipating heat; and, during some months of the year, they require to compensate this by some artificial means, in order to maintain the warmth necessary to health and activity. Our contemporary says that only a small amount of energy is required in some cases to supply the deficiency; and, if we could find a way of transmitting the energy direct to the system, the process of artificial heating would be much more efficient than it is in general. On the occasion that Mr. Beauchamp delivered himself on this subject, the Chairman was Major Vincent Smith; and he reminded the Director of the Electrical Development Association of the electrically heated clothing which has proved such a boon to airmen—a remarkable feature of the clothing being the small amount of energy needed to keep men warm, even in an arctic environment. We admit frankly that neither coal nor gas can manage this kind of thing. Electricity can. We give it all the honour it deserves for the achievement. But we are not disposed to live in electrically heated clothes. Besides being rather cumbersome, and impeding to movements, their continuous use would be, we should fancy, somewhat unhealthy. But it is thought the idea might be developed in the warming of factories and public buildings. How is not explained. Our contemporary thinks the flow of thought which Mr. Beauchamp produced in this connection, but which he did not follow up, suggests the need for a thorough study of the whole subject of artificial heat in the light of the potentialities of electricity. In such research, the physicist, the physiologist, the manufacturer, the salesman, and the user should be combined. In his concluding remarks, the writer says: "A good deal has been done towards attempting to make electricity take the place of gas and coal on their own ground; but what is most needed is an approach to the problem from a new angle—that of the peculiar properties of electrically produced heat. Electricity is not simply a substitute. It opens out a field of its own, which deserves to be exploited by fresh minds." We think a mistake has been made in referring to the "peculiar properties of electrically produced heat." Whatever is "peculiar" lies merely in the ability to apply it to fresh uses, for which we fear there will not be a very large demand.

Where Electricity is Cheap and Gas Dear.

Winnipeg does not in the matter of gas and electricity supplies represent the conditions in this country. The city has a hydro-electricity supply. Electricity is therefore cheap; while gas is supplied at $1.70, which is equal to 7s. 1d. per 1000 c.ft.! Mr. E. V. Caton, the Chief Engineer of the Company supplying water-generated electricity, has written to the "Electrical Times" to point out that electricity can compete with gas for cooking and water heating; but he is careful to say that he declines to generalize. He is wise. And no one will deny that, under certain conditions, electricity can compete for these purposes, but not in this country, where electricity is in the main steam generated, and compulsorily so. In Winnipeg, current for cooking is supplied at ½d. per unit, with 10 p.ct. discount for cash payment. For hot-water supply, small circulating heaters are encouraged; and they are constantly connected to a small tank. In this case, flat-rates are charged: $3 per month for a 1-KW. heater; $5 for a 2-KW. heater; $6 for a 3-KW. heater; and $8 for a 4-KW. heater. As the result of an intensive campaign, some 5000 electric cooking ranges for domestic service have been fixed, and about 1000 water-heaters. This is not surprising in view of the relative prices of gas and electricity, seeing that so many people are always ready to buy something new if it is only going to cost (say) about the same for running. Mr. Caton says that, under his conditions, experience shows that at the present rates for gas and electricity, it costs two to three times more for cooking by the former than by the latter. If this is so, then for all cooking operations Winnipeg must have found some highly efficient electric ovens and heating elements, and some highly inefficient gas-cookers, inasmuch as the potential heating energy supplied by the two agents is probably about similar for an equal expenditure at the rates charged. But if the running cost of gas is two or three times what it is for electricity, then this means that electricity is two to three times more efficient, assuming approximate equality in heating energy for the same cost. If this is so, then why is it that electric cooking has not made greater progress in this country, notwithstanding that the cost of potential heat energy supplied electrically is so much greater than for potential heat energy supplied by gas? A great deal is known about electric cooking, water heating, and so forth in this country; and the electrical people are well aware that their competitor here has the better of them in the contest for business. It is noted that Mr. Caton admits that owing to the concentration of the load for cooking, radical changes have had to be made in the distribution system. Also that, at the prices charged, they are able to make a "slight" profit on the load. Even in Winnipeg, with its hydro-generation, apparently difficulties have been found.

Price of Electricity.

It is predicted that this year will see a general movement in price reduction for electricity. We may entertain the belief that the same statement will apply to gas. Coal and railway rates are the elements in expenditure which it is said make the reduction of electricity prices possible. There are other matters which influence the movement. One is the general fall in prices of all materials, and therefore of plant. The advice has gone forth that the opportunity should be taken to adopt a tariff—the bi-part tariff is the favoured one—which will enable heating, cooking, vacuum cleaners, washing-machines, and all else to be domestically established without the installation of a double system of wiring and two meters. Of course, there would be a saving in this respect. But unfortunately what is advocated means a long purse; and what with rents and rates and taxes being high, householders are generally searching for ways to economize, and not to take on fresh obligations. But there is one thing that should be done while revision is being made in electricity charges, and that is to drop the percentage additions to the pre-war charge, and consolidate this charge with the necessary remainder of the percentage addition. The Electricity Committee of the Leeds Corporation are doing this in making a reduction in the charges as from April 1 next. The present price represents an addition of 80 p.ct. on the pre-war scale of charges, and the new charges will contain 50 p.ct. on the pre-war rates for power and 70 p.ct. for lighting and heating.

Lighting Workmen's Dwellings.

Up North there is a disposition to speculate in the lighting of workmen's dwellings with electricity. The Durham Rural District Council have been discussing the question of lighting in connection with their Belmont and Sherburn housing schemes. The Chairman of a Committee who have the Belmont scheme in hand confessed that the stumbling-block to going forward with electricity was the initial outlay; but, nevertheless, he believed in the long-run electricity would be the cheapest illuminant. At York, the Corporation Electricity Committee have decided to instal electricity in working-class dwellings on the deferred payment system. The houses in two streets are to be the subjects of an experiment, which the sanguine ones believe will be a success. We rather fancy that, unless the houses belong to them, the tenants will soon tire of parting with the instalment of payment, in addition to paying for current and lamp renewals. The popularity of the prepayment gas-meter system is found not only in the convenience, but in the fact that the pennies placed in the slot end the obligations of the householder.

Foundry Work and Electric Furnaces.

An interesting little article by Mr. James Edgar has appeared in the "Electrical Review" on the subject of the use of electric furnaces in iron foundries and steel works. In the former, the electric furnace does not make headway. There are very few electric furnaces used for foundry work, although there are in this country over 3000 foundries. In these, combustion furnaces are the rule. Mr. Edgar admits that their efficiency is relatively high—about 40 p.ct., and comparatively cheap. From 2 to 5 cwt. of coke will melt a ton of metal. But he calls attention to the fact that the melting is done in the oxidizing influence of the blast, which is harmful notably to the manganese and silicon. These combustion furnaces have been in use a long time; and there has been little complaint. Any failings, of course, always become magnified by the advocates of a process which seeks to depose a system already well-established.

Mr. Edgar is candid. The foundrymen like the system to which they are accustomed. He confesses it is cheap; and he acknowledges that it is improbable the electric furnace will oust the combustion furnace from the foundry "for a considerable time." He is safe in the prediction. Electric energy must become much cheaper for the purpose. Nevertheless, good points are claimed for the electric furnace. One is that the melting is done in a reducing atmosphere, and there is thus no oxidation; and the second is that the high degree of superheating ensures good castings. But when Mr. Edgar turns to steel, of course there is nothing, in his opinion, like the electrically melted variety. But furnaces of much larger capacity will have to be made to cope with all classes of work. Castings are more costly under the electric system, because, in addition to the expense of electrical energy, the upkeep of the furnace lining is heavy, owing to the high temperatures. Savings in linings can only be effected by keeping the furnaces going all the time. These are points about which little is heard; but the cost of the electrical operation is something over which the steel makers ponder deeply.

Special Orders.

Procedure by Special Orders in getting new powers is a simple and economical course compared with applications by Bill to Parliament. The "Electrician" calls attention to the increasing use that is being made of this method of supplementing powers. It instances two cases. In one, as the Electricity Supply (No. 2) Bill is dead, and there is no definite idea as to when it will be revived, or as to what it will contain, Edmundson's Electricity Supply Corporation are applying for six Special Orders, which, if granted, will enable the Ministry of Transport to deal with the necessary revision of the maximum prices of undertakings established under 21 Provisional Orders. For such small undertakings, operating in areas that are not the best possible for business development, the restricted maximum prices the Electricity Commissioners can allow are insufficient. The proposal, if acceded to, would remove the disability to grant more. Another example is a Special Order of the Stepney Borough Council, which is to enable them to acquire compulsorily and use additional land for their Limehouse generating station, as well as to exempt them from indictments and proceedings for nuisance on account of the working of the station. The Council are hardly likely to secure this, except in respect of nuisances unavoidably caused.

GAS BILLS FOR 1922.

[FIRST ARTICLE.]

THE Private Bills lodged for the coming session of Parliament in which gas matters are dealt with are not strong either numerically or materially; and therefore so far as the gas industry is concerned, it will be a very lean session. This, of course, is due largely to the revision work that is going on under Section 1 of the Gas Regulation Act, and to the facilities that are offered to gas undertakings for obtaining additional powers under Section 10 of the same Act, and which facilities are becoming quite popular. To-day we commence the review of such Bills as contain interest for us.

The first measure to be noticed is that of the BIRMINGHAM CORPORATION; but there is very little in it which specially affects the municipal gas-works. Part VII. alludes to the retailing of coke; the provisions being for the protection of the public. They are very much in the ordinary form, and provide that where coke is sold by weight, and exceeds 2 cwt. in quantity, the seller must deliver to the purchaser before the load is discharged a ticket or note as nearly as may be according to the form in the third schedule to the Weights and Measures Act of 1889, or according to a form to the like effect. Default in complying with this regulation will involve a penalty not exceeding £5. Succeeding sections provide for the weighing or re-weighing of coke, as well as for regulating the sale of coke under 2 cwt. in quantity. In the financial section of the Bill, the Corporation asked for power to borrow such money as may be necessary for the purposes of working capital for their water, gas, or markets undertakings, with the consent of the Minister of Health. In respect of the application of the revenues of the trading undertakings, there is a provision that the Corporation may, if they think fit, apply money received by them on account of the revenue of any of the undertakings to the construction, extension, and improvement of the works and conveniences for such undertaking, and to the provision of funds for working capital. Money is only to be so applied after the working and establishment expenses of the undertakings, and the interest on sinking-fund payments, have been provided for. The undertakings referred to are the water, gas, electricity, markets, and tramways. Nothing in the measure is to take away or prejudicially affect any of the rights, remedies, or priorities of the holders of gas annuities granted by the Corporation under the Birmingham Corporation Gas Act, 1875. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, & Co.*]

The BLACKBURN CORPORATION have deposited a Bill for the extension of the borough boundaries. In connection with it, they have come to an agreement with the District Council of Oswaldtwistle for the defining of the limits of supply in one part of the district. This agreement it is seen is dated as far back as Oct. 18, 1917. It seems that the Corporation are supplying property in the township of Oswaldtwistle; and the agreement provides for the ceasing of the rights of the Corporation, and for the buying of the plant by the District Council, associated with the supply to that area. The consideration for the transfer and sale is to be the fair market value at the time the Council give the Corporation notice of their intention to supply gas. In estimating the amount of the consideration, nothing is to be included for goodwill; but due regard is to be had to the profits made by the Corporation from the supply of gas within the specified area. Should there be any dispute with respect to the amount of consideration, the matter is to be referred to the arbitration of a competent valuer to be appointed by the Secretary of the Institution of Gas Engineers. A few clauses of quite ordinary character succeed. One empowers the Corporation to refuse to supply gas in certain cases. Another refers to stand-by supplies, and a third deals with anti-fluctuators to be used with gas-engines. Among some miscellaneous clauses, the Corporation provide that in any case in which, in consequence of any default on the part of the occupier of any premises, the Corporation have cut-off the supply of water, gas, or electricity, should the occupier desire to resume the supply, he is to pay the expense of reconnecting it. [*Parliamentary Agents: Messrs. Sherwood & Co.*]

The BOLTON CORPORATION are promoting an extensive Omnibus Bill. One part of it has relation to powers for instituting superannuation funds on behalf of officers and servants of the Corporation. The scale of superannuation allowances is on the lines of one-sixtieth of the average annual amounts of the salary or wages of the officer or servant entitled thereto during the five years ending on the day which immediately precedes the day on which the officer or servant ceases to hold his office, multiplied by the number of complete years comprised in the service or aggregated service of the officer or servant. But in no case is such allowance to exceed forty-sixtieths of the average annual amount. There are a great number of clauses referring to this matter. Under the head of finance, provision is made for the expenses incurred by the Corporation in carrying into execution the provisions of the present measure. In regard to those incurred for purposes of the electricity or gas undertakings, they are to be made out of the revenue of these undertakings respectively; and if in any year the revenue is insufficient for the purpose to which it is applicable, the deficiency is to be made-up out of the district funds and district rates. Later on in the Bill a clause is seen which enables the Corporation from time to time to borrow such sum or sums as they may require for the redemption of any gas annuities which they may agree with any holder to purchase or redeem. Any moneys borrowed under the powers of this section is to be on the security of the revenue of the gas undertaking and of the district funds and district rates; and the prescribed period for the repayment of the moneys so borrowed shall for the purposes of this part of the Act be such period, not exceeding sixty years from the date of the borrowing, as the Corporation may determine. Among the miscellaneous clauses, the Corporation take power for the purpose of their gas and electricity undertakings to fit up showrooms and offices, and exhibit specimen installations, and give demonstrations of the uses to which gas and electrical energy can be put. [*Parliamentary Agents: Messrs. Dyson, Bell, & Co.*]

In the financial section of the Bill of the DONCASTER CORPORATION, power is taken to borrow, with the sanction of the Minister of Health, any money which may be necessary for the purpose of providing funds for working capital for the water and gas undertakings respectively. Regarding the application of the revenues of the trading undertakings of the Corporation, power is taken, if thought fit, to apply money received by them on account of revenue to the construction, extension, and improvement of the works and conveniences, and in the provision of funds for working capital, provided that money shall only be so applied after the working and establishment expenses of the undertaking and the interest and sinking-fund payments in respect thereto have been provided for. [*Parliamentary Agents: Messrs. Sherwood & Co.*]

A Bill promoted by the NEATH CORPORATION is intended to extend the boundaries of the borough, and to confer further powers with respect to the water, gas, and electricity undertakings. In the section devoted to gas, the clauses are quite ordinary in the powers they seek to confer. In the first place, provision is made for gas-fittings let on hire to continue the property of the Corporation. Other clauses refer to the laying of pipes in private streets, period of error in defective meters, and to the price of gas varying according to the purpose for which it is supplied, with the stipulation that the Corporation shall not under these powers give any preferential price as between any consumers who shall take a supply of gas for the same purpose under like circumstances. The Corporation also desire to be freed from the obligation to give from any main a supply of gas for any purpose other than lighting or domestic use in any case where the capacity of the main is insufficient for the purpose, or if, and so long as, any such supply would, in the opinion of the Corporation, interfere with the sufficiency of the gas required to be supplied by means of such main for domestic purposes. Permission is sought to contract for the supply of gas in bulk, and to purchase gas in a crude or partially purified state. In respect of finance, the expenses incurred by the Corporation in carrying into execution the provisions of the present measure are to be paid,

so far as they apply, from the revenue of the appropriate undertaking. In the miscellaneous part of the Bill, the Corporation take power to (with the consent of the owner of any buildings, wall, or bridge) attach brackets, wires, lamps, and apparatus for street lighting purposes. [*Parliamentary Agents: Messrs. Dyson, Bell, & Co.*]

In a voluminous Bill, the RAMSGATE CORPORATION have a short part referring to the gas undertaking. The first clause under this section provides that the Corporation may make such reasonable charges as they may think fit when they are required by an owner or occupier of premises to read a meter index at any time other than the usual times for doing so, or to render an account of their charges for the supply of gas to such premises for any period less than three months, or to render such account at any time other than the usual times for doing so. A stand-by clause is included, which provides that the Corporation shall be entitled to charge a minimum sum not exceeding £2 for any one quarter of a year, provided that, in fixing the amount of such minimum charge, the Corporation shall have regard to the probable maximum supply of gas which might be at any time required for such premises. It is further provided that in respect of any premises for which the whole supply of gas is taken through a meter having a nominal capacity of less than ten lights, the amount of the minimum charge shall not exceed 10s. for any one quarter of the year. Among other clauses is one which empowers the Corporation to set aside from the revenue account moneys to provide a fund for working capital, which fund is not at any time to amount to a sum exceeding one-third of the average amount of the revenue received by the undertaking in each of the three years immediately preceding the date at which the amount of the fund is calculated. Differential prices for gas are also provided for. Superannuation fund clauses follow. Among the amounts which the Corporation desire to borrow is £20,000 for working capital for the gas undertaking. It is asked that the repayment period shall be fifteen years. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, & Co.*]

THE DOMESTIC COKE FIRE.

By Prof. C. V. BOYS, F.R.S.

I HAVE frequently noticed references to coke as fuel in an open fireplace, and to the difficulty of burning it; and your comments in the current issue of the "JOURNAL," on Dr. Margaret White Fishenden's investigations, indicate that you consider the question to be one still worthy of discussion. As I regularly burn gas coke in an open fire in my house in Hampshire, and greatly prefer it to coal, which I will not use, and I have no special devices of any kind, and have no difficulty in its use, it is possible that you may be able to find space for a short account of my method.

The particular fireplace is an ordinary well fire, which I found already there when I took possession. There was an arched cast-iron set of fire-bars in one piece over an ash-pit, as usual, and certain air passages in a raised hearth to feed air to this ashpit. I removed the iron-bar casting, and filled-up the ashpit with common brickbats, and blocked the airways in the raised hearth. After very little use, every crevice between the brickbats is filled with compacted ash. There are no fire-bars, and there is no iron left in the fire-place. Such a construction, with no provision for draught, is the antithesis of all that I have seen recommended as necessary for burning coke; but it works perfectly, and without difficulty.

Coke is said to be difficult to light. It is more difficult to get it started, perhaps; but it is all red hot in far less time than coal requires, as all the heat needed to decompose the coal and distil the products up the chimney is saved, unless the coke is very wet—and even then some of it is saved. A coke fire burning on a hearth with a fireclay backing draws in its air through the front; and this is all that is needed. Unnecessary combustion, due to a supply of air from below, sends much heat as hot gas up the chimney, and no doubt some into the room as radiation from a hotter fire. A coke fire of this kind once started may, if desired, be quite a small affair in one corner of the hearth, where the fire-brick behind, at the side, and below prevents undue loss of heat; and only a very moderate convection draught is sufficient to provide the combustion needed for the small radiation from the front and top, and the coke continues to burn for a long time at a low temperature. If a hotter fire is needed, it is only necessary to increase its size, and with its size its depth. Then the draught is stronger, the temperature is higher, and the radiation is greater in a still higher degree.

In really cold weather, I use the larger pieces of coke in front, and fill in behind to a greater depth; and I can get any fire I like, large or small, with certainty and regularity equal nearly in this respect to a gas-fire. It is better than a gas-fire in one way. If, for instance, a small fire is wanted in the afternoon, with a large hot fire for tea (say), with no one present to make a change, this can be arranged with certainty by not making-up until the fire is rather low, raking all the fire into one corner, and then putting on so much coke as is necessary. The first burning is very slow; gradually the coke is all hot, and there is a splendid fire for making toast—nearly equal in this respect to a gas-fire—when wanted.

Coke differs in the amount of ash. I am told that my village coal merchant obtains his coke from Bristol. It is good coke; but there is plenty of ash. The fire is made-up two or three times a days; and on these occasions it is well lifted by a poker, to allow the ash to settle below the coke. But at other times the poker should not be used. When lighting the fire, we use mainly small pieces; but when the fire is going, large pieces in front are desirable. All the small and dust is burned by putting this on when the open fire is burning well. The small is simply deposited gently on the top. It must not be disturbed, for in that case it will settle-down into the ash, and to a great extent be lost. On the top it burns quietly and well, and occasionally trickles down to lower levels.

A coke fire does not go out in the way that does a fire made of caking coal, which is apt to become a solid arch over an empty space; and it does not require the dirty work of chimney sweeping to be conducted in a room. The chimney of the fireplace in question has not been swept in the eight years in which coke or wood, or sometimes garden rubbish, has been burned.

I should like to add that, some years ago, I cut a piece of sheet iron with a few holes punched in it, and placed this so as very nearly to block the chimney. The holes are at the back; and their total area is very few square inches. Two useful effects follow. There is no longer the inrush of cold air through a ventilating opening in the wall, bringing far more air than is needed for good ventilation, and chilling the room; but there is quite enough. The temperature within the chimney is much higher; and all the fire gases infallibly find their way into the chimney, and not into the room. Further, the increase in temperature of the walls in the two rooms in the storey above on either side of the chimney is not far from double what it was, thus keeping these rooms aired more efficiently than before. Also, in gusty weather, when any chimney may be buffeted by an unfavourable eddy, the warmer gases within give a stronger chimney action; and should even this be overcome, there is only a restricted way for a down rush.

PERSONAL.

The question of salaries of officials was discussed at length at last week's meeting of the Manchester City Council. In the course of the proceedings, Alderman Kay moved that Mr. J. R. HILL (Manager of the Bradford Road Gas-Works) should be appointed Acting Engineer, to control the several gas-works and the lighting department of the city, at an inclusive salary of £1000 per annum; and that Mr. A. L. HOLTON should be appointed Manager of the Bradford Road works, at an inclusive salary of £850 a year, with house, coal, and gas. Mr. Hill's present salary, he said, was £650, and the bonus £340. In the case of Mr. Holton, his present salary was £475, and his bonus £308. The increases were therefore very small. There were some protests against the appointments; but they were not pressed, and the motion was carried.

It has been decided by the Ramsgate Gas and Water Committee to appoint Mr. R. H. RUTHVEN, of Morecambe, to succeed the late Mr. William Thomson as Engineer and Manager of their gas and water undertaking. Originally Mr. Ruthven was at Kendal, where he was an articled pupil, first under Mr. Thomson and then under Mr. W. R. Wilson. On the completion of his articles, he was appointed Assistant Manager of the Kendal Gas-Works. Later he followed Mr. Thomson to Ramsgate, as Chief Assistant Engineer and Manager; and five years ago he was appointed to his present position as Engineer and Manager of the Morecambe Gas-Works. At the same meeting, the Ramsgate Corporation appointed as Commercial Assistant Mr. FREDERICK G. SALE, who was Mr. Thomson's Secretary. It was also decided that a sum of £50 should be paid to Mr. Ruthven towards the cost of his removal to Ramsgate.

OBITUARY.

Both the Boards and officials of the Imperial Continental Gas Association and the Continental Union Gas Company have lost a valued friend by the death on the 9th inst., suddenly, after a long illness, of Sir ARTHUR LUCAS, who was Deputy-Chairman of these undertakings. For many years he was Chairman of the Great Ormond Street Children's Hospital; and his work and generosity were in 1919 rewarded by a knighthood. After being educated at University College School and University College, London, he worked as a civil engineer; and as a pupil of Sir John Hawkshaw he was engaged in the making of the Underground Railway. Sir Arthur was 76 years of age.

A meeting of the Illuminating Engineering Society is to be held at the Royal Society of Arts, at 8 o'clock on Tuesday, Jan. 31, to discuss the "Use of Light as an Aid to Aerial Navigation."

A paper entitled "Some Observations on a Producer-Gas Power Plant" is to be read by Messrs. H. S. Denny, C.B.E., and N. V. S. Knibbs, B.Sc., before the Institution of Mechanical Engineers on Friday, the 20th inst.

Among wills lately proved are those of Alderman James Fielden, J.P., of Gloucester, Joint Managing-Director of Messrs. Fielden and Platt, Ltd., who left estate of the value of £48,270; and of Mr. Stephen Kavanagh, J.P., a Director of the Kingston-on-Thames Gas Company, who left £68,017.

THE CO-OPERATION OF THE ENGINEER AND CHEMIST IN THE CONTROL OF PLANTS AND PROCESSES.

By G. M. GILL, Chief Engineer to the South Metropolitan Gas Company.

[A Paper read last Friday evening at a Joint Meeting of the Institution of Mechanical Engineers with the Society of Chemical Industry.]

A great need exists to-day for the supply of materials which have some pretence of being standardized, with quality, size, and general characteristics much more uniform than is frequently the case with most manufactured commodities. With such variations in raw and other materials used for manufacturing purposes, it becomes a difficult problem to work plant and processes efficiently, and in such a way as to produce articles of standard quality and quantity. As a result, great loss is caused to the country's trade and industry generally.

It is proposed in this paper to deal specifically with coal and refractory materials, and to outline a system which has been applied with the object of standardizing the quality of gas. The South Metropolitan Gas Company, being a user of coal to the extent of 1¼ million tons per annum, have found it desirable to establish a fully-equipped laboratory and inspecting staff at Newcastle-on-Tyne, for the purpose of examining coals supplied to the Company. The coal is sampled as it is loaded into the Company's ships, after which the samples are analyzed, and all coal above a definite size is hand-picked free from dirt; the results being telegraphed to London in time to give those responsible for the operation of the works an opportunity of regulating the carbonizing plant to suit the varying grades of coal before its arrival. This system is still in its infancy; but excellent results are anticipated, not only from the point of view of better informed buying, but also of improvement in the cleaning of coals, and in the working of plant to suit each consignment of coal. One of the Company's stations has already instituted a system of carbonizing by which automatic adjustments are made varying with the volatile content in each consignment of coal. It should here be explained that, in good carbonizing, from 90 to 95 p.ct. of the volatile content of the coal is converted into gas and liquid products; and as the percentage of volatile matter in the coals used varies from (say) 24 to 34, it will be realized that the one class of coal needs very different treatment to the other, though it is a factor which has hitherto been neglected in gas-works practice, owing to lack of information.

The author has summarized the results of these tests in the case of four typical coals, which are fairly representative of a larger number similarly examined. These results are given in detail in figs. 1, 2, 3, and 4. The author claims to have no practical knowledge of coal mining, and cannot therefore give any indication of the limits of quality within which coals could be supplied. The diagrams, at any rate, show the variation in quality of coals actually being supplied, from the study of which it must be evident to practical users that considerable alterations in the regulation of plant are inevitable when coal so variable in quality is in daily use.

In gas-works generally the class of coal in use is varying in some cases from hour to hour, and in others from day to day; and as consignments of coal differ so largely, it is not customary to alter the regulation of plant until some time after a fresh class of coal has been in use and its effect has become apparent to those in charge. This change is generally too late for full advantage to be taken of the characteristics of the coal; but if this could be done before a commencement is made on a fresh class of coal, much benefit would be derived. At the present time, the name of a coal is the only indication of its quality and characteristics; but, as will be seen from the diagrams, each coal varies so largely that the name is little indication of its quality. Coal is everywhere bought, not by quality, but by name; and its price varies with the general reputation of the name in question. But these diagrams serve to show that there is so wide a variation in the quality of each coal that the worst cargoes of a so-called first-class coal are inferior to the best of a second-class coal. There is, in fact, a large element of chance in regard to the quality of any particular consignment.

The author would suggest that the time has arrived when each colliery should grade or classify the coals from the various pits and seams, keeping each grade of the same quality within the narrowest practical limits. The advantages of such a step to the users would be very great; and this would react favourably upon the whole coal industry. To a gas undertaking, it would result in higher yields of gas and products per ton of coal and per unit of plant, a higher output per man, and a smaller variation in the quality of gas made; and these would have the effect of reducing he price of gas. The desired improvement would be much nearer achievement if the coal were picked more efficiently and consistently, though, of course, this is not the whole of the problem.

In examining the samples of coals, these are screened through

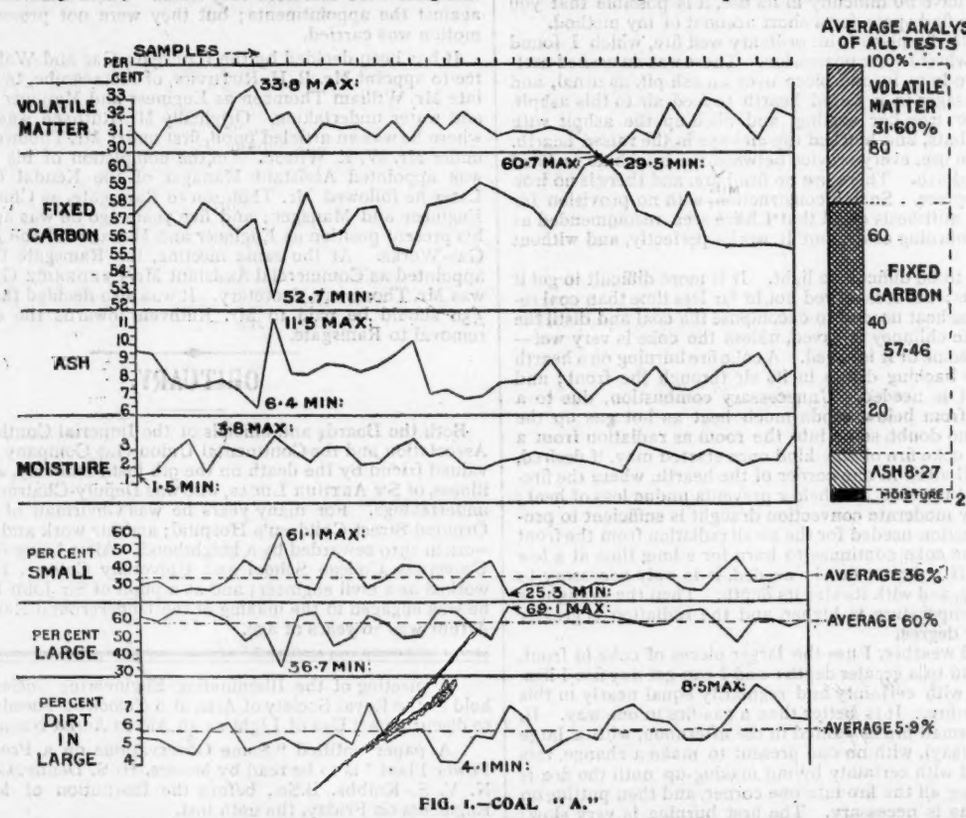


FIG. 1.—COAL "A."

Shows the results of the examination of samples of Coal A; each sample being representative of a consignment of about 1000 tons. The figures are calculated upon the wet basis; while the figures for "fixed carbon" are free from ash. The lower portion of the diagram shows the relative proportion of small and large in each sample, while the bottom line indicates the percentage of dirt hand-picked from the "large" portion of the sample; this latter giving a good indication of the efficiency with which the particular coal was hand-picked on the picking-belts at the colliery. It will be noticed that, in the case of six samples, the percentage of dirt in the "large" portion of the coal amounted to over 7 p.ct., which indicates very bad work on the part of those responsible for picking-out this dirt.

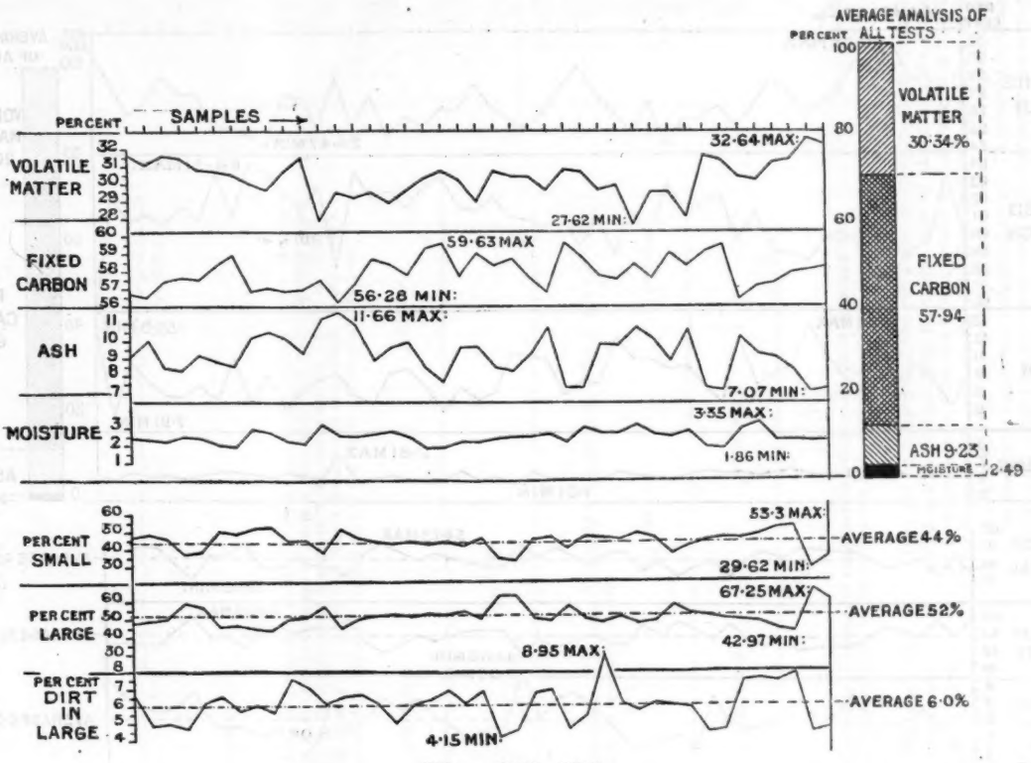


FIG. 2.—COAL "B."

As in the case of Coal A, seven of the samples of Coal B contained over 7 p.ct. of dirt in the "large" portion of the coal, which again emphasizes the possibility of improvement in the quality of coal as a result of more careful picking. It will be noticed that the consignments with the lowest percentages of ash had generally the lowest percentages of dirt in the "large" portion of the coal, showing the extent to which this removable impurity affects the ash content.

a sieve with holes ½ in. square; and the coarse portion not passing through is hand-picked free from dirt, the quantities of which dirt are shown in the diagrams. A study of these figures makes it quite clear that the picking process at the pits is a haphazard one, varying possibly in efficiency with the dates of the football matches in the district. The presence of this superfluous dirt in the coal causes untold loss in a gas-works. There is not only the fact that the buyer is receiving dirt instead of coal, but the dirt is transferred to the coke which is used in the furnaces for heating the retorts in which the coal is carbonized. In practice, the heating of the retorts is very greatly affected by the amount of dirt in the coke; and, as a consequence, its presence in the original coal is most objectionable.

The author would suggest that, in the working of a colliery, continuous sampling of the coal as it reaches the surface should be the daily and nightly duty of chemists, who would test the coal both physically and chemically, supplying the superintendent in charge with complete records of the quality of the coal, by which system the quality could readily be standardized within limits varying with the consistency of the particular seams. The working of such a system would entail the employment of chemists in the collieries to a much greater extent than is now the case; and this would lead to the production of a better and more uniform quality of coal.

The effect of such improvement would undoubtedly be far reaching; and, while the author holds no brief for chemists, he is strongly of opinion that their presence at the engineer's side is essential to the proper conduct of industries generally. Here in the working of collieries is clearly fine scope for mutual co-operation between the members of the two professions.

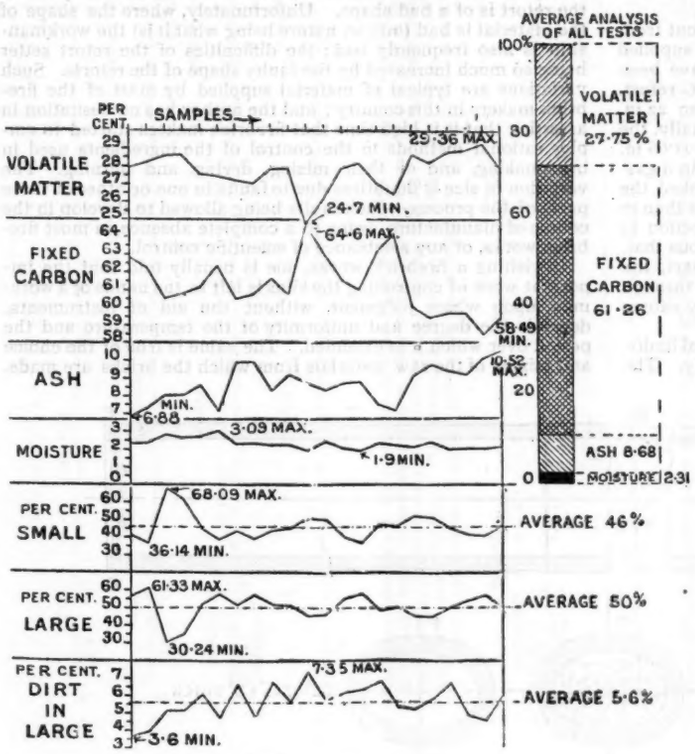


FIG. 3.—COAL "C."

It will be noticed that Coal C contains more "fixed carbon" and less volatile matter than Coals A and B, rendering it more valuable for coke making, and less valuable for gas making, than Coals A and B. It will be seen that the percentage of volatile matter varies from 24·7 to 29·3, or 16·6 p.ct. based upon the average of 27·7 p.ct.; and as the amount of gas contained in the coal depends upon this portion of the coal, it will readily be appreciated that a variation of this amount will interfere very greatly with the output of a gas-making plant. In this case, only one consignment contained over 7 p.ct. of dirt in the "large" portion of the coal.

TABLE I.—*Showing the Maximum and Minimum Dimensions found by examining twenty-four Firebricks (of each of two well-known makers) chosen at random from a stack of such bricks. The Correct Dimensions should be 9 in. by 4·5 in. by 3 in.*

—	Length.	Breadth.	Thickness.
	Inches.	Inches.	Inches.
MAKER (A)—			
Maximum . . .	9·30	4·56	3·16
Minimum . . .	9·01	4·40	2·90
Difference . . .	0·29	0·16	0·26
MAKER (B)			
Maximum . . .	9·35	4·5	3·12
Minimum . . .	8·92	4·27	2·87
Difference . . .	0·43	0·23	0·25

REFRACTORIES.

The variation in size and quality of firebricks and blocks and retorts is one of the most unsatisfactory features with which users of refractories have to

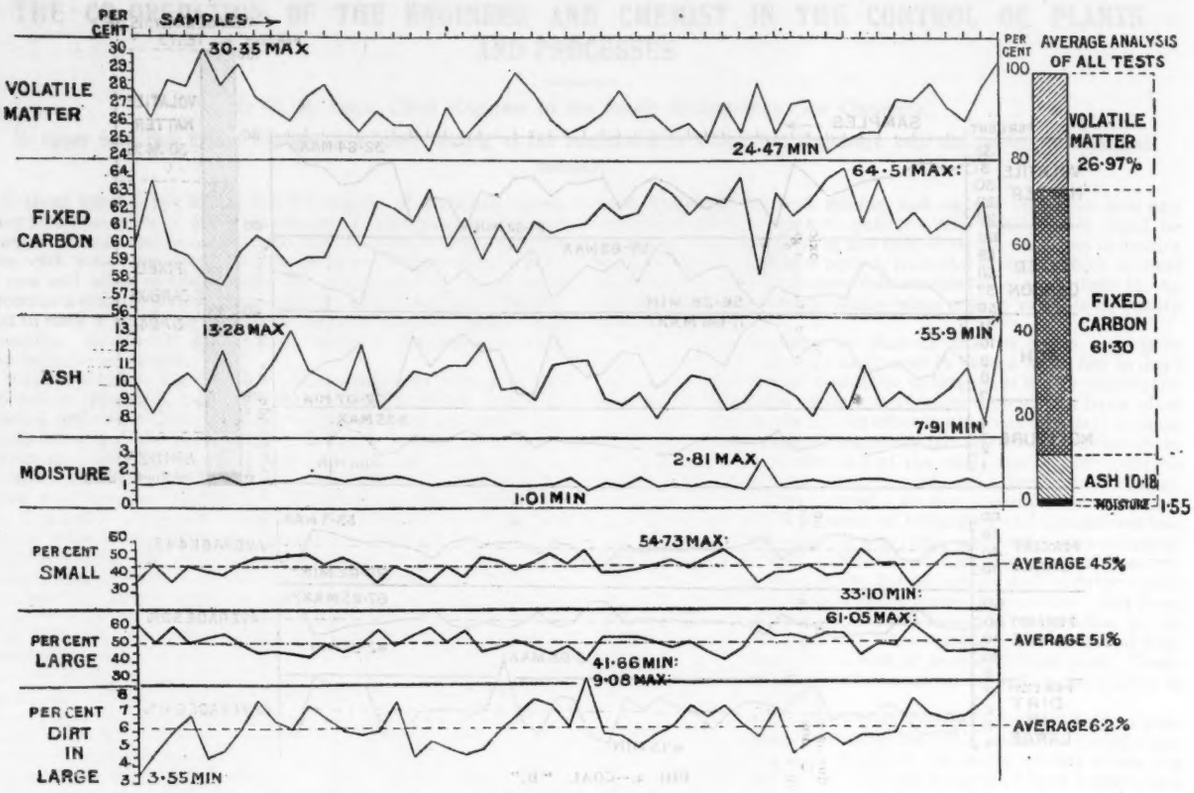


FIG. 4.—COAL "D."

Coal D has the same general characteristics as Coal C, and might be termed a coke-making coal but for its high ash content. In this case thirteen consignments contained over 7 p.ct. of dirt in the "large" portion of the coal; while the variation in the percentage of volatile matter is even more marked than is the case in Coal C.

contend. All kinds of difficult problems have to be faced for want of uniformity in this respect. Table I. shows the varying length, width, and thickness of firebricks supplied by two well-known makers in this country.

Fig. 5 shows three pieces of retort which were picked-out from seven pieces chosen at random from a quantity in stock supplied by a well-known manufacturer. These three pieces have been placed together to make-up the usual length of a 20-ft. retort. The internal dimensions of these pieces should have been 22 in. by 15½ in. of an oval section, as shown in fig. 5. Actually, the dimensions in the 20-ft. length vary from 22·50 in. to 21·68 in. wide, and from 15·50 in. to 15·31 in. in height. As used in a gas-works, these retorts are charged with coal, and when coked the appearance is as shown in fig. 5. The charge of coke has then to be pushed out at one side; and in some cases the direction in which it is pushed is varied from day to day. It is obvious that, where one part of the retort is larger than another part, the charge in the larger part can only with difficulty be pushed through the smaller part of the retort; and this fact undoubtedly causes practical difficulties in working.

The dimensions of the retorts should be, within practical limits, the same from end to end, both internally and externally. The internal dimensions affect the discharging operations, and the external dimensions affect the building of the settings; a large amount of cutting of bricks and blocks being necessary where the retort is of a bad shape. Unfortunately, where the shape of the material is bad (human nature being what it is) the workmanship is also frequently bad; the difficulties of the retort setter being so much increased by the faulty shape of the retorts. Such variations are typical of material supplied by most of the firebrick makers in this country; and the author has no hesitation in asserting that it is high time that firebrick makers started to employ rational methods in the control of the ingredients used in brickmaking, and of their mixing, drying, and burning. The variation in size is doubtless due to faults in one or other of these parts of the process—such faults being allowed to develop in the course of manufacture, owing to a complete absence, in most firebrick works, of any semblance of scientific control.

In visiting a firebrick works, one is usually told that the important work of controlling the kilns is left in the hands of a workman, upon whose judgment, without the aid of instruments, depends the degree and uniformity of the temperature and the period over which it is extended. The same is true of the choice and mixing of the raw materials from which the bricks are made.

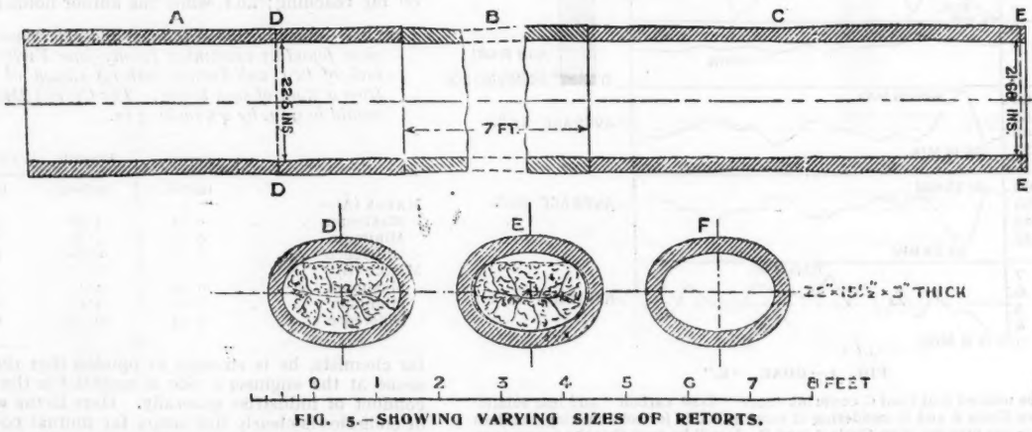


FIG. 5.—SHOWING VARYING SIZES OF RETORTS.

Shows three pieces of retort chosen from seven pieces picked at random from a number of retorts supplied by one maker. The largest piece is shown at A, the middle size piece at B, and the smallest at C. D shows a section through piece A where marked D D, and E a section through piece C where marked E E. In D is shown a typical view of a charge of coke ready to be discharged; and in E is shown the same portion of the charge and its relative size to the retort at the smallest end, from which it will be seen that the charge where laid in the largest part of the retort is larger than the smallest part of the retort, through which it has to be pushed by a machine. F shows the correct sectional dimensions of the retorts.

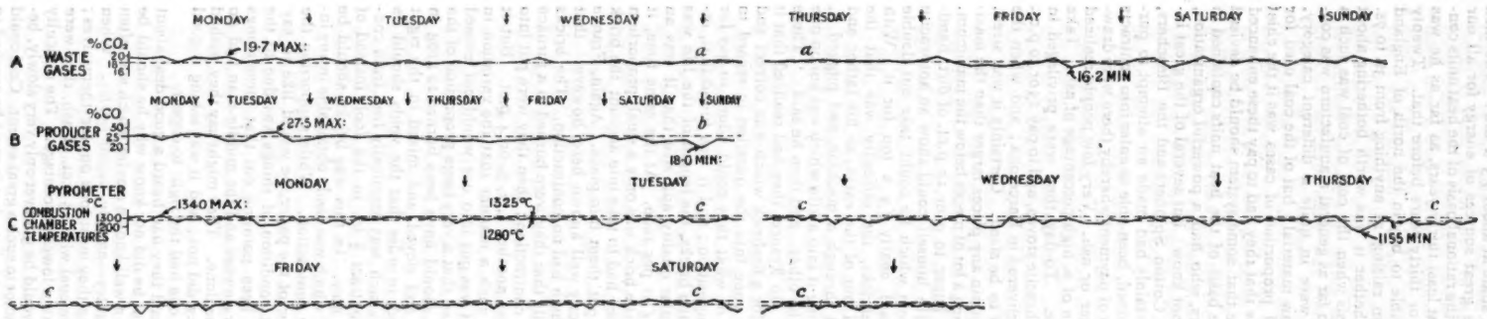


FIG. 6.

This shows the tests in the retort-houses made by the shift chemists or testers at one of the Company's works during one complete week. A shows the percentage of carbon dioxide (CO_2) in the waste gases leaving one or other of the retort-settings. 18 p.ct. CO_2 is the Company's standard. B shows the percentage of carbon monoxide (CO) in the producer gas leaving the producers heating the retort-settings. 25 p.ct. CO is the Company's standard. C shows the temperature in the combustion chambers of the retort-setting. 1280° to 1325° C. is the Company's standard. The standards are indicated by dot-and-dash lines. It should be mentioned that these figures do not quite represent the average conditions, as the tester's work is upon occasions concentrated upon the retort-settings which are not working so well as the others. The results, therefore, tend to record the worst, rather than the best.

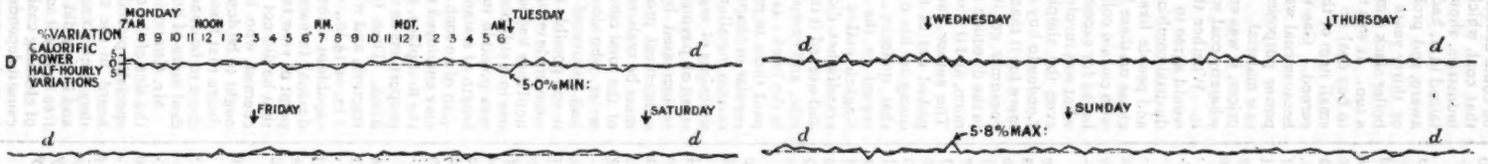


FIG. 7.

This shows the percentage variation of the calorific power of the coal gas being made each half-hour throughout the same week. The required quality being 550 gross B.Th.U. per c.ft. Fig. 7 indicates the extent to which the gas being made is over or under the requisite quality.

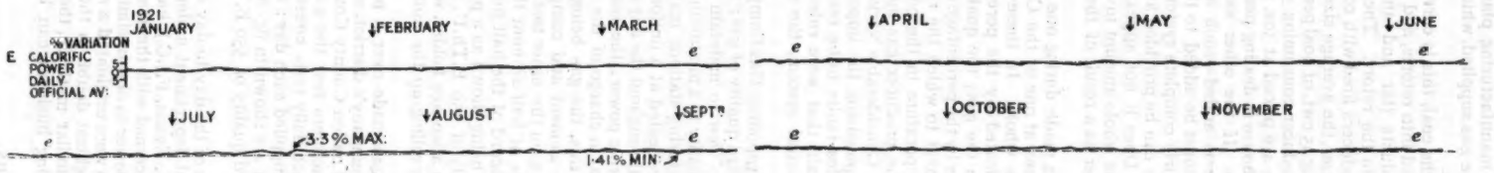


FIG. 8.

This shows the daily percentage variation from the standard calorific power of the gas supplied by the Company, as certified by independent examiners working under the instructions of the London County Council. These are based upon the average results of the tests made at the six official testing-stations in the Company's district of gas supply.

To anyone accustomed to the aid which is given by chemists and others whose duties consist of keeping a regular check upon all the factors which contribute to the maintenance of uniformity in the quality of manufactured commodities, it is, of course, obvious that the absence of this absolutely necessary assistance can but result in the defects of which mention has been made.

In the building of any structure of refractory materials, it is highly important that the joints between bricks and blocks should be as thin as possible, the bricks being "buttered" only; and consequently it is all-important that the thickness of such bricks should be uniform, as otherwise the bricklayer must either sort over all the bricks to get those of a similar thickness to lay in one course or he must increase the thickness of the joint wherever the thin bricks are laid. In either case the remedy is very objectionable. Here, again, there is scope for the chemist to work in conjunction with the engineer or manufacturer.

What appears to the author to be necessary in the conduct of firebrick works is the institution of methods providing for:

(1) The continuous sampling and analyses of mixtures in use, both chemical and physical.
(2) The use of heat-recorders in kilns.
(3) Definite limiting standards for size and shape.
(4) Guaranteed working to specifications.

It might be argued that the extra cost of applying these methods would not be forthcoming from the sale of the materials made, or, in other words, that the bricks would be too expensive to sell. The control proposed would doubtless lead to the production of It is suggested that the contrary result would be experienced. a higher and more consistent quality of brick. This would increase the sales, and consequently lower overhead charges in the works. The control would further diminish rejected bricks, save fuel costs in kilns, increase capacity of plant, and effect improvements which would result from increased knowledge of the process. At present the most enlightened refractory users are searching the country for a better quality of materials, which, it will be agreed,

is of far greater importance than that of price—important, of course, though that be.

Refractory users are hopeful, though not confident, that they may find what they require in this country. They do not want to go abroad for their materials; and if this course has to be taken, it will be because they have been driven to it by the apathy of the British refractory manufacturer.

Control of Plant for Making Standard Gas.

The South Metropolitan Gas Company have applied scientific control, both to the working of the manufacturing plant and to the maintenance of the quality of the gas supplied, which is standard in quality within narrow limits.

To start with the carbonizing of the coal, this is carried out in retort-houses, where the coal is placed into retorts, and there distilled into gas and the liquid products (tar and ammoniacal liquor); the residue coke being left in the retort. These retorts are heated by producer gas from producers fired with coke. The Company have seventeen retort-houses, the average size of which contains 246 retorts, each carbonizing 25 cwt. of coal per 24 hours. Sixteen retorts are heated by one producer consuming 3·7 tons of coke per 24 hours. If coal and coke are priced at 30s. per ton, it will be seen that the average retort-house is dealing per 24 hours with raw material valued at £546. If the other expenditure entailed in working a retort-house is added—such as labour, upkeep, and power—a further £168 must be added to this figure, making a total of £714 a day. A fairly complete system of control by means of chemists and testers can be provided at an additional cost of £3 8s. per 24 hours. Does it not appear obvious that this expenditure—0·5 p.ct. of the whole amount involved—is likely to be recouped many times over as a result of the more intelligent working of the plant?

Fig. 6 gives the results of all tests made during one complete seven-day week in three retort-houses at one of the Company's stations; these being typical of the whole. In these tests the quality of the producer gas is indicated by the percentage of carbon monoxide (CO) contained in the gas; the quality of the waste gases leaving the retort-settings by the percentage of carbon dioxide (CO_2); while the degree of heat to which the retorts are being subjected is shown by the temperature in the combustion chamber of the settings, in which the producer gas meets a hot supply of air, and is there burnt. Considerable variations are shown in all these figures; this emphasizing the importance of carrying out such tests, which enables faults to be remedied as soon as disclosed. It is quite certain that were rule-of-thumb methods allowed to replace the control system, the variations would be much wider.

As explained above, the South Metropolitan Gas Company have adopted a policy of supplying a standard quality of gas; this being 550 B.Th.U. per cubic foot. With a view to maintain the standard, and to reducing variations in quality to a minimum, a typical system in use at one of the manufacturing stations may here be described. The gas being made is collected at a uniform rate in a small test gasholder for each hour throughout the day and night. It is then tested every hour for calorific power; the result being immediately telephoned to the official in charge of the manufacturing operations. In addition to this, the gas being made is tested midway between the commencement and completion of each hourly sample. This is a check on the other test; the two figures giving the official at intervals of half-an-hour the quality of the gas being made. A typical record of the half-hourly tests is shown in the diagram fig. 7; these being shown as a percentage above or below the standard quality of 550 B.Th.U. per cubic foot. The gas as made passes into a storage holder, which acts as an efficient mixing vessel, thus levelling-up the hourly variations.

Finally, the holder in which the gas made over a period has been mixed is used to supply the Company's district, situated at six different points upon which are London County Council testing-stations, where independent examiners test the gas several times daily. The average of all such daily tests constitutes the official figure of the quality of gas supplied each day; and those reported since the beginning of 1921 are shown in fig. 8 as a percentage above or below the standard quality of 550 B.Th.U. per cubic foot.

The author, having had experience of the day-to-day collaboration with a well-constituted chemical department under the control of the Chief Chemist (Mr. E. V. Evans, F.I.C.), has no hesitation in recommending others concerned with the manufacture of any commodity to do all in their power to obtain similar assistance. These standardizing methods were originated a number of years ago; and there is not the slightest doubt, in the author's opinion, that, by the adoption of similar methods, the stability and prosperity of any manufacturing business can be greatly improved.

DISCUSSION.

The Chairman (Captain H. Riall Sankey, President of the Institution of Mechanical Engineers), in opening, said that this was the third of the joint meetings between the Institution of Mechanical Engineers and the Society of Chemical Industry; and he hoped there would be more of them as time went on, because he regarded them as of great importance. From the paper it appeared quite definitely that the South Metropolitan Gas Company had found it necessary to establish a laboratory, both for analysis purposes and for control, in order to improve the quality of product, and also to reduce cost. The author had suggested that at least two other industries should do likewise; and they would all agree that what he had said on that point was right. He called upon Dr. Stephen Miall, as representing the Society of Chemical Industry, to open the discussion.

Dr. Stephen Miall considered it was quite beyond his power to contribute anything to the technical side of the discussion; and as there were many present who would be able to make valuable contributions, he confined himself to expressing his thanks.

Dr. W. R. Ormandy said he was not sure whether the author's faith in humanity was not the thing that had struck him most. He had complained that the colliery owner did not employ chemists. Was it likely that the colliery owner was going to engage chemists so long as he could continue selling roofing shale at about £3 a ton? The idea that coal, which was one of the great sources of energy for all our industries, should be bought on the rational basis of the heat units contained in it, had been urged for at least thirty years, as far as he was aware, and probably for twenty or thirty years before that. Twenty or thirty years ago it was possible to buy in the north of England boiler slack (small coal) for steam raising, at anything from 3s. to 7s. a ton. It was then a question whether it was worth bothering about to buy coal on the heat-unit basis when the cost of coal was such a small item of the output costs, so far as general manufacture was concerned. Gas-works, however, were in quite a different category, because coal was the principal raw material; but of the coal used for power purposes, only in a small proportion of cases was it the chief raw material. Nevertheless, now that they had to pay these enhanced prices, it was eminently desirable that some system should be devised whereby coal was bought on the basis of the heat units contained in it. Whether the colliery owners, who had a powerful organization, would agree to it or not, he did not know; but several of the great industrial combines, like the Fine Cotton Spinners and the Bleachers, and people like Lever Bros., certainly had made an attempt to purchase on these lines, and had, indeed, been able to enter into contracts with certain collieries on a system of payment whereby there were drawbacks for excess amounts of water or ash. Very few people realized what was involved in the question of a high percentage of ash. Take even the simple household case. To-day they were privileged in London to buy anthracite for anthracite stoves, and to pay 25 or 30 p.ct. more for it than the same coal delivered in Barcelona; and when the consumer got it, it was supposed to be sized. Certainly it was sized, in the direction that it did not contain any pieces larger than the maximum, and it was also sized in having a lot of pieces below the maximum. The author had referred in his paper to 9 or 10 p.ct. of dirt, hand-picked out of the large coal. He himself could show an anthracite dump in his own back yard from which he could take out double that quantity; and he had paid nearly £5 a ton for it. With regard to the question of firebricks, the difficulty was that the English maker dug his material out of the earth, as his father and grandfather did. He pushed it through a machine, and pugged it, and worked it into bricks, by putting it into a kiln which was hot on one side, and comparatively hot on the other; and then he said: "There is the brick; take it or leave it." In France, they had realized that it paid them to pay 80 p.ct. more for a firebrick which was correct and regular in shape. He had once gone into the question in regard to certain metallurgical operations of what they could afford to pay for firebricks of regular size and composition; and it was found that, instead of paying £4 per 1000 for the bricks, the length of the life was so increased by getting the regular quality and size that it was an economical proposition to pay £40 per 1000. At the same time, it must be realized that the cost of the brick was only a small proportion of the total cost of a retort. They had to take into account the brick setter, who slowly and solemnly put them into place. Again, France had discovered—what was perfectly well known here, however—that it was possible to make bricks which had no contraction. The bricks were made in such a way ordinarily that they were burned in a furnace until they had lost 6 or 7 p.ct. by contraction; then they were put into use in a still hotter place, and lost another 1, 2, 3, or 4 p.ct. But it was possible to make bricks in such a manner that the variation in length of a standard brick after it was put into use would not exceed $\frac{1}{16}$th of an inch. This necessitated that a very large proportion of the clay employed to make the brick should have been burned to grog in the first place, and then ground and sieved, and mixed in the right proportions as concrete was mixed, in order that the voids should be filled. Then they got a brick which was practically free from contraction, and which would not contract $\frac{1}{4}$ in. in the foot, instead of 1 in. or 1$\frac{1}{2}$ in., which was usual now. In this way bricks should be capable of withstanding the 1200° which was easily obtainable in any industrial furnace, without further contraction. While supporting the point of view taken by the author of the paper, he would like to say that he did not think the present condition of things was due to the chemist, who long enough had been pointing out that these things ought to be done; but the colliery owner and the middle-man had no desire that these things should be done. They might say they wished them to be done, but at heart they did not; and it was asking a good deal more of human nature than one had the right to expect.

Mr. Christopher W. James said they had heard a good deal about the sins of the colliery owner; but he did not know why he should be specially picked out. There was a well-known maxim which was often heard in the courts of this country—namely, *caveat emptor*. When they were going to buy something they must look out for themselves; and if they did not like anthracite coal with 25 p.ct. of ash, they were free to buy it somewhere else with a lower percentage. The difficulty of cleaning coal was one which would be got over only very slowly, because it depended on the human factor to such a great extent. Coal could be made comparatively clean by washing it; but it must be crushed to sufficient fineness first. If that small coal were washed, it could be got to a very high degree of purity, and all the dirt practically eliminated. He had hoped to hear something in the paper about the products of distillation. They were referred to as gas, tar, and solid matter; but he was hoping to learn something as to whether more valuable products could be obtained by distilling coal at different temperatures from those usually adopted in the gas-works, because there were a great many products to be obtained from coal by distillation at different temperatures. Every now and then they heard something in the Press about low-temperature carbonization. He would like to know whether such processes resulted in more valuable products, and

whether the resulting coke had a higher value than that obtained from ordinary gas-works processes.

Mr. E. R. DOLBY said he proposed to confine his remarks to carbon dioxide and firebricks. He could not claim any specialized knowledge of gas-works practice; but, as a consulting engineer, he had been engaged upon work in connection with institutions and factories, and it had always been his endeavour to improve the efficiency of fuel consumption. For this purpose he had, in a number of cases, installed CO_2 recorders; but he must say that most of them seemed more suitable for the laboratory, in the hands of an expert, than to be placed in the care of the ordinary engineer-in-charge who was usually to be found at such institutions. In these circumstances, he had been a little interested in the curve in the paper showing the CO_2 percentage taken over a week. It was pointed out in the paper that the standard aimed at was 18 p.ct. If they examined that curve, it would be found that it was practically a straight line; and he would like the author to tell him the name of that instrument, because he envied him those results very greatly. Was it a recording instrument, and were special precautions necessary in taking the observations? With regard to firebrick, his experience was chiefly in the setting of Lancashire, Cornish, or B. & W. boilers. If they worked solely with one brick—for example, Stourbridge—they had merely the irregularities of that one brick to deal with; but when handling the setting of a B. & W. or other type of water-tube boiler, it was often desirable to use Stourbridge firebricks for the moderate temperatures, and another type of firebrick, such as Glenboig, for the position which was more exposed to excessive heat. This complicated the matter still more, because they had two variables to deal with; and it was very annoying to have to have two qualities of brick in courses usually corresponding with one another.

Prof. J. W. HINCHLEY thought the author had proved the necessity for the existence of the chemical engineer, not only in the gas and firebrick industries, but in other industries. He had definitely adopted the position that in the gas industry that particular type of engineer, the gas engineer, needed some consideration from outside industries, and particularly the firebrick makers and the people who made retorts. After all, what was science but organized common sense, based upon the experimental determination of natural facts; and the author had shown how, by organizing common sense in manufacturing work, it was possible to attain much higher standards of efficiency. The human factor must receive far more consideration in the future than it had done in the past; and it was a part of the same problem—namely, to get everybody to work together to produce the maximum efficiency in our industries. He was not quite sure whether the author's method of showing the analyses in the form of curves was quite the best plan. The position of the chemical engineer in industry to-day was an extremely difficult one; but he was necessary if industry was going to obtain exactly what it wanted. If they demanded a firebrick, for instance, which did not contract more than 1-16th of an inch in length, and which must have a certain depth and breadth, they should get it if they insisted; but as long as they were content to accept a second-class thing, they could go on accepting it. This was one of the things which must be realized—that if they would not accept what was offered to them, ultimately they should get something better. The chemical industry in this country owed a good deal of its progress before the war to the manufacture of chemical plant in such a country as Germany, simply because there they devoted themselves to chemical engineering problems, and turned out stoneware and plant which did its work; whereas in this country they found to-day the same dearth of chemical engineering as they found before the war, and manufacturers were going back to their old awful methods. In his opinion, the commercial man was a great deal to blame, because he engaged a man to buy, for instance, firebricks, who knew nothing whatever about them. No doubt Mr. Gill had a voice in the purchase of his firebricks; but there were large numbers of engineers in our works who had no voice whatever in the purchase of materials. He remembered the case of the head of one of the biggest spirit distilleries, who was in charge of the works, and did not know that he was distilling alcohol. He only became aware of it when he was dragged into a court of law to give evidence. Before then, he only knew that he distilled spirits; and he (Prof. Hinchley) had been through chemical works during the war and since, where the manager was not aware that what he was dealing with was sulphate of iron. He only knew it as copperas; and it was this kind of ignorance in their industries to-day that they had to get rid of. It could only be done by hammering at it, and refusing to buy materials from any firm, and encouraging this sort of thing. He was with Mr. Gill wholeheartedly in his demand for a higher standard of accomplishment. By all means let them pay more for their materials, because they would find eventually that the more accurate they made a thing, the cheaper it was generally.

Mr. W. NEWTON BOOTH thought that one of the things which Mr. Gill wished to emphasize was the necessity for standardization. Anyone who knew sufficient of the work of the South Metropolitan Gas Company would realize how far this Company had gone in achieving standardized results so far as their products were concerned. He was particularly interested in the question of coal—partly because he had been working on the same problem himself, and partly because Mr. Gill was actually doing something which he himself was only just setting-out to do. He would like to know how the sampling of the coal was done at Newcastle, because it was by no means an easy job to take samples of a consignment of 3000 or 4000 tons. Unless the sample was accurately taken, the result was hardly worth the paper it was written on. The sampling of coal was one of the most serious problems with which they had to contend; and he would like to know how it was carried out in Mr. Gill's case. He would also inquire whether any attempt had been made by the South Metropolitan Company to arrange contracts by which payment was made on the basis of the quality. He himself was working in this direction, but had found very great reluctance on the part of the coal owners to accept new methods of selling coal. So long as the owners could do as they did during the war—namely, send out material containing 10 p.ct. of dirt, and get paid for it as coal—they would go on doing it. As regards firebricks, he wished to know whether the bricks referred to in the paper were hand-made or machine-made, because the variations mentioned were rather more than he had come across himself when using a considerable quantity of firebrick. The paper was hardly what one would have expected from its title, because it was headed "Co-operation;" but there was very little about co-operation in it. That co-operation was necessary and advisable, no one would deny, especially when one realized the possibilities behind the scientific investigation of the various problems arising in ordinary works practice, which afforded ample opportunities for co-operation between the chemist and the engineer. The call in the gas and other industries was for continually increasing qualities of refractory materials. The chemist was already pointing the way to answering that call, first by purifying the clay—Dr. Ormandy could tell them a good deal about that if he had the opportunity—and then by the introduction of other materials than the silica and alumina compounds which formed the basis of the ordinary firebrick. There were such things as carborundum, which was coming more and more into use as a high-temperature refractory; alundum, which was another similar product; and then there was the newest one of all, zirconium, which seemed to have possibilities in regard to high-temperature work which would place it in the forefront of refractories where the call was for a sufficiently high quality to pay for the comparatively high price.

Mr. J. A. REAVELL (Chairman of the Chemical Engineering Group of the Society of Chemical Industry) expressed the opinion that many British industries to-day were suffering because they did not recognize the absolute necessity for co-operation between the engineer and the chemist. It was not a question of the chemist *versus* the engineer, or *vice versâ*. They must admit that everything in manufacture must come down to engineering—that was the bedrock of civilization. The chemist must work with the engineer, and the co-operation that was needed was that of a chemical engineer who knew the thoughts of the one and could translate them into the actions of the other. The question as to whether the seller should have a chemist, or the buyer should have a chemist, seemed to be beside the point. They had heard from the author about the buying of coal, and he sympathized with one of the speakers who said that if the buyer was fool enough to buy dirt instead of coal, then it was certainly his own look-out. Personally, he thought that both the buyer and the seller should have a chemist; and then the chemical engineer would be the man to work-out the different points and get the problem into its proper light. A little while ago, he had to examine some tenders for evaporation plant in which there was a great variation in price. The chemist wanted a certain plant, and the buyer, who was a buyer such as had been described by a previous speaker (who knew nothing whatever about it) wanted the cheapest article. The chemist knew exactly what he wanted, as far as the chemical work was concerned; but as far as the mechanical work was concerned, he knew nothing about it at all. On looking over these tenders, he (Mr. Reavell) found that the buyer was going to place an order for plant at a very low price; but he had to point out to him that the seller was offering him a plant to do certain evaporations, and he had based his price on using the expression "from and at." The seller had not taken the temperature of the cold liquor, but the liquor with a very high boiling point. It seemed never to have occurred, even to the chemist, that somebody had got to heat 14 tons of liquor an hour up to boiling point before it went into the apparatus; and it was that which accounted for the enormous difference in price. "From and at" did not mean anything to anybody. The mechanical engineer knew what it meant, so far as boiler tests were concerned; and here was a case in which there was no competition between the chemist and the engineer, but the absolute necessity for co-operation between the two. Another good illustration as to the necessity for co-operation between the chemist and the engineer was in the buying of tubes for use in chemical works. Take the very common use of tubes, in connection with caustic soda. They could go to any of the standard tube makers and say they wanted solid-drawn tube for use in caustic soda-boiling. The manufacturer would show them a tube, and say it was so much a foot; but when asked as to whether it would stand the boiling of caustic soda of such and such Twaddel, he would say he did not know. His answer usually was that the purchaser wanted the tube, and not the seller, and that as seller he was perfectly willing to sell as many thousand feet as were required. They could not, however, afford to pay £2000 for tubes in order to find out whether John Smith's tube was no use for caustic soda. As a contrast to their methods, he had recently been offered from the Continent some material, and a very intelligent letter had been written, saying that caustic soda of such and such a density, and of such and such a boiling point, required a certain tube. What was the result? It was that the order went to the man who provided the goods; and, as Dr. Ormandy had said, there was no need to worry about the price, because they were getting the goods they wanted. This was what they would do every time; and that was really where co-operation between the chemist and the engineer came in. They wanted a chemist on both sides, and then co-operation between the chemist and the engineer, so that the man who was selling knew what he was selling, and the man who was buying knew what he was buying. Only in that way would this country get a chance. They had the brains in this country, and the knowledge, but they were fools in the way they applied it.

Mr. E. A. ALLIOTT expressed his disappointment that the author had not gone more fully into the question of co-operation between the chemist and the engineer. Of course, in an ideal world they would have a chemical engineer who knew everything about engineering and chemistry, and then there would be no need for co-operation. Unfortunately, at the present time, in this imperfect world, that mythological beast did not exist; and they had to divide him into two sub-species—one being the engineer, with a very sound engineering knowledge of a particular branch of engineering, and at least sufficient knowledge of chemistry to appreciate what the chemist meant, and, as the second sub-species, the chemist, with a thorough knowledge of his particular branch of chemistry, with sufficient common sense to realize the practical conditions involved in the application of plant. The first step in co-operation between these two was in the designing. They would have to set-down first of all the conditions to be fulfilled in treating any particular chemical or chemical material; and questions of temperature, pressure, corrosion, &c., would have to be discussed.

There, of course, the chemist could help the engineer by advising him of the small variations in the material, and their effect, impurities, and so forth. These were very important points, which must not be overlooked. Then there was the question of the material of which the chemical plant was to be built. There, again, the chemist could come in with his knowledge of corrosion factors and so forth, and help the engineer very considerably. Finally, there was the size, shape, and strength of the plant, which was very largely a pure engineering problem. Here again, however, the chemist could help, with his knowledge of certain factors, such as the important factor of the transmission of heat through heating surfaces. Then came the position when the plant was in operation. The importance of chemical knowledge then became more and more emphasized. Take the question of filtration. They might put in a filter press or a centrifugal to do certain filtering operations. There was not much that the engineer could do in this connection, except to vary the speeds or pressure; but the chemist, and the engineer who understood what chemistry involved—the chemical engineer—would understand that the best output could not be obtained from that plant unless the material came to it in the right state. For instance, one might have some material which at one time was comparatively crystalline and at another time highly gelatinous; and this would affect the output of the plant possibly detrimentally. There was nothing that the engineer could do to help that—it was the chemist who must come in for this part of the process. The engineer required to have sufficient chemical knowledge to realize this, and to look to the chemist to help him, and, conversely, the chemist should realize it was up to him to help the engineer to get the output from the plant. Coming to the question of evaporation again, an engineer could build an evaporator to do a certain job—take, for instance, the question of handling soap lyes. The engineer could build a plant of suitable dimensions to give a certain output, if it were reasonably worked; but he could not get that output with any reasonable size of plant unless the chemist came in and looked after things a bit. For instance, the chemist had to watch that there was not too much organic matter in the soap lyes, or else it became too thick in the final operation, and the capacity would be cut down. Then there was the question of inorganic salts. If there were too much of certain constituents, the salt that came down would not filter properly, and they would not be able to get the salt away sufficiently dry, or sufficiently quickly, from the salt box of the evaporator. Again, if the chemist allowed grease to come in, the capacity of his evaporator would be very much cut down. All this demonstrated that the chemist and the engineer, or the two branches of the chemical engineer, must co-operate—otherwise the results would not be satisfactory. Occasionally they came across a buyer with less common sense than usual; and he might ask them to guarantee the plant. The counter to that was to ask him to guarantee his material; but he was not anxious to do that. They would, however, realize, from what he had said, that there was a certain importance about that. In designing plants, they had either got to assume that the sample of the material which had to be treated was better than the bulk of the material would be; and in that case the only course to adopt was to design the plant of a larger size than would be necessary if they could be assured that the bulk of the material was up to sample. As a matter of fact, this was what was usually done; but it was not an economical proposition to build plants which were too large for their purpose. The other alternative was to take the sample as it stood, and design the plant accordingly; but then they ran the risk of getting a plant which would not give the required output. Thus, there was evidence of the real need for co-operation between the engineering side and the chemical side, in order that plant might be designed on economical lines and the costs of operation and maintenance reduced to such a level as to enable them to compete with people elsewhere.

Mr. W. A. TOOKEY confirmed all that had been said as to the necessity for co-operation between the engineer and the chemist. His experience was that both spoke a different language from the other, and the more opportunities there were of their meeting together and instructing each other in the elementary phrases of their respective languages, the better it would be. It was not every mechanical engineer who had the opportunity of getting into intimate touch with chemists, and it was not every chemist who had the opportunity of getting into intimate touch with the mechanical engineer; and one of the difficulties he had found was that they were frequently at loggerheads because they did not understand each other's language. His experience had also shown him that many difficulties between engineers and chemists could be overcome by tackling the particular problem in another way. He congratulated Mr. Gill on the success which the South Metropolitan Company had achieved in maintaining a standard quality of gas, in spite of the difficulties that had been referred to in the paper, which were largely dependent on the volatile material of the coal. The coke bulked very largely indeed in gas manufacture; and he was wondering if the difficulties would be so immense if there were an alteration of the process which would vary the percentages of volatiles. Were they yet sure that the present process of gas making was right? And might they not get a cheaper and better gas, of more regular quality, if they bulked the two together—*i.e.*, the volatiles and the coke—more than was the case in present-day practice?

Mr. R. C. MACDONALD said he had recently been reading an autobiography of Mr. Andrew Carnegie; and one of the most interesting parts in the book to him was that dealing with the introduction of the smelting of iron in America, and the introduction of chemical control there. The result of this introduction of chemical control was the discovery that a great deal of iron ore that had previously been thrown on one side as unsuitable for making iron proved to be the most valuable iron ore that could be obtained. It occurred to him that something of the same sort might be the case in connection with the manufacture of refractory materials; and he looked forward to great competition among refractory material makers as the result of the discussion in order to ascertain methods of improving their products.

Mr. L. M. JOCKEL, speaking as one interested in the use of large quantities of coal for steam raising, said that during 1921 he handled 50,000 tons of coal; and the tests he made fully bore out everything the author had said as to quality variations. The figures he was going to give related to Midland coal coming into the Metropolitan area from a distance of about 150 miles. The average moisture in his coal during 1921 was 11·3 p.ct. by weight, the volatile matter 24·2 p ct., the fixed carbon (or carbonaceous content) 59·2 p.ct., and the ash 16·5 p.ct. He had also been interested in the figures of minima and maxima mentioned in the paper, and had looked-up some of his own figures. He found that the minimum total moisture for the year was 2·7 p.ct., and the maximum 19 6 p.ct. The minimum volatile matter was 23 p.ct., and the maximum 32 p.ct. The fixed carbon minimum was 52 p.ct., and the maximum 69·9 p.ct. The ash minimum was 5 6 p.ct., and the maximum 32·2 p.ct. In all these figures he had carefully excluded the three months of the coal strike, and deliveries which were affected by it. Using these coals, his furnace efficiency, to put it vulgarly, was all over the shop, and it was impossible to maintain high boiler efficiencies when the coal varied within such wide limits. He regretted that they had not heard more about the sampling and testing of coal, because it seemed that in the United States they had taken this matter up earlier than they had, with more or less satisfactory results. He heartily endorsed everything Mr. Gill had said about refractories. Only that morning he had been engaged inside a furnace, looking at some refractories, and had been struck with the variation in the sizes of the bricks. Some of the variations exceeded those mentioned by Mr. Gill; and he had discovered that at least 10 p.ct. of the total labour cost was involved in the time spent by the men sorting the bricks out to a uniform size. He was rather surprised at the figures quoted by Mr. Gill with regard to carbon dioxide content; and he was afraid that steam engineers could not do quite so well. They could not maintain a figure of anything like 18 p.ct. in practice—in fact, the figure was generally about double that; and this was particularly the case when using oil fuel.

Mr. W. H. PATCHELL, in closing the discussion, thought both Institutions should congratulate themselves upon this third joint meeting. He had received a letter from Mr. E. V. Evans, the Chairman of the London Section of the Society of Chemical Industry, expressing his regret at his inability to get away from Manchester for the meeting. He would very much have liked Mr. Evans to be present, because he was the Chief Chemist to the South Metropolitan Gas Company, and Mr. Gill was their Chief Engineer. There was no doubt that the case for the collaboration of the chemist and the engineer had been proved. They had all been working hard for it for some time, and they needed to be much closer together than they had been. The learned societies also needed to get closer together. Closer federation was required and closer co-operation in this direction, so that they could see more of each other to discuss these matters. If that were done, he was sure it would be for the public good. He did not care whether it was co-operation or affiliation, so long as they did get together. The relation of the iron and steel industries to the chemical industry was dealt with recently in a paper in America by Mr. Cramp, before the Iron and Steel Institute there, and the figures given showing how the chemist could work in with the iron and steel industry were perfectly astonishing. Of the sulphuric acid made in America, 10 p.ct. was absorbed by one steel company alone—the Standard Company. No less than 600,000 tons of sulphuric acid were handled by the American steel industries, 10,000 tons of hydrochloric acid, 22,000 tons of sulphur, and 36,700 tons of sal ammoniac, &c. If the iron and steel industries used these large quantities of chemicals, was there not need for close co-operation between the chemist and the engineer? The analyses of the coals "A," "B," and "C" in Mr. Gill's paper interested him very much. It had been pointed out that in the "B" and "C" coals the ash was in the large dirt, but that in the "A" coal it was not in the large dirt but in the bulk. Coal at the collieries which he himself had had most to do with went over a 2-in. screen; then the large went over the picking band; and the small, if they were lucky or the colliery owner was so inclined, went to the washery. If a man would wash his coal, he generally found it paid; and it certainly paid the buyer when the heavy cost of cartage was taken into consideration. In connection with washed coal, there had been some extraordinary experiences with froth flotation; and by this means the Powell Duffryn Company had got what they called a super-coke for metallurgical purposes. An extraordinary amount of the dirt had been taken out of the fine coal, which was powdered finer than usual before being put through the froth-flotation process and placed into the coke-ovens. In this way they obtained a super-coke which had qualities which no previous coke had had. Thus they could have their coal picked on the belts, or it could be roughly washed, or, if they wanted it finer still, they could use the froth-flotation process. Therefore, there was no limit to the cleanness with which coal could be supplied. It was purely a question of paying for it. Would it pay? Mr. James had said that if they did not like the coal that was being supplied, they need not take it; but Mr. James had only just come to London. He had come from off the coalfields, where they could choose as they pleased. It was like living in a pie shop—if one pie did not suit they could take another. But in the matter of coal in London it was very different. He had bought anthracite at £5 a ton and had had to buy other coal to burn it. Mr Fedden, the Chief Electrical Engineer at Sheffield, had said in that room not long ago that he had been getting 20 and 30 p.ct. of ash. With South Wales small 20 p.ct. of ash was a good old standard if it were used on the job; but they usually took more care when they were sending it away. There was no difficulty in getting good work out of 20 p.ct. of ash on the job; Mr. Bennis once said he had burned stuff containing 50 and 60 p.ct. of ash. Indeed, it was possible to burn bricks; but it depended on how far it paid you to burn them. If they had 50 p.ct. of ash on a train of 100 trucks, this meant there were only fifty trucks containing coal; and they could see what the transport people and the coal people, working together, were in for. The question of firebricks was very important for a reason other than the one mentioned by the author. The bricks must match up. One speaker mentioned that he had had to match with brick of another kind. Those who were familiar with the old B. & W. boilers would recollect that they used to employ ordinary bricks for the outer part of the setting and firebricks for the fire side of the setting. He himself had never done this; but he had used glazed bricks on the outside of the boiler in order to stop leakage. At the same time, he had never

found a glazed brick which would match up with a firebrick, or *vice versâ*. He always used a low grade outside and a high grade inside, and this was where the difficulty came in. Nevertheless, there should not be this difficulty if, as Dr. Ormandy had said, the clay was mixed in such a way that the shrinkage was known and arrangements made accordingly. At present, the clay used in firebrick making went through the mysterious process called weathering; and that was all that happened to it. The cost of brick setting was almost more important than the cost of the bricks; and the cost of repairs was worse still. One speaker mentioned that it would pay to pay a higher price. He knew of people who were using carborundum bricks where they did not pay per 1000, but per brick; and it paid to do it. Then there was the question of the temperature the firebrick would stand; and not only that, but what would be the action of the ash in the coal at these high temperatures. Engineers did not know this, and it was these things that chemists were wanted for. At the same time, the chemist could not tell these things from the laboratory; he must come out into the works and understand the works processes. He sympathized with Prof. Hinchley as regards the buyer, but there was also the seller to remember. Indeed, during Prof. Hinchley's remarks he was not sure when he meant the buyer and when he meant the seller. It was, however, a very bad business that there were so many sellers on the road who knew so little of what they were trying to sell.

Mr. GILL, replying to the discussion, expressed his general thanks for the manner in which the paper had been received. Dr. Ormandy had given a lot of useful information; but it called for no reply from him. Both Mr. James and Mr. Patchell had spoken about the washing of coal. Not many gas-works used washed coal—in fact, he did not know that there was much available for gas-making purposes. At the same time, it must not be overlooked that a good deal of water was left in coal that had been washed; and this had to be got out before they could start gas-making. They lost a lot of ash by washing, but gained a good deal of water. As to low-temperature carbonization, gas people generally were not greatly enamoured of this. There were many snags in it; and the gas engineer generally could see a good deal more money in what he was doing than in what he was not doing. Low-temperature carbonization would very likely come-in in the future; but from the carbonization point of view, it was not altogether much of a process. Mr. Dolby spoke of the CO_2 figures. All his producers were deep ones. There was a deep bed of fuel; and he did not regard the figures he had given in the paper as being very special ones. There was no great difficulty, with ordinary control, in gas-works, to get figures within those limits of 16·2 and 19·7 p.ct. The recorder used was, he believed, the Orsat. Mr. Dolby had also spoken of different makes of brick, which contracted and behaved differently under high temperatures. His Company in the past had used certain bricks which expanded in one part of the setting, and bricks which contracted in another part; and to a large extent, they counteracted each other. It would, of course, be better still to use bricks of a material which did not expand or contract; and this was gradually becoming possible. Things were getting a little better in this respect. Brick-makers were gradually giving more attention to this point, though they were in a small minority at present. Before the war, his Company went to Germany for all their retorts, because they could not get the necessary quality in this country. When he told them his Company had 18 miles of retorts in use, they would realize what a big thing it was. As to insisting upon having what they wanted, as mentioned by Prof. Hinchley, he dare say this would come about in time; but it took a very long time. In the meantime, they had got to take what they could get, because they could not get what they wanted. Prof. Hinchley also made the point of paying more—that quality was the great thing, and price of secondary importance. He absolutely agreed, especially in the case of refractories, because it was all-important to use the right material, provided the cost was within reasonable limits. As to sampling, mentioned by Mr. Booth, the coal was tipped down shoots into the ships, and as it came down, something like a bucket at the end of a stick was immersed into the coal at fairly frequent intervals right through the time the cargo was being loaded. The sampler could not see what was coming down, because it came down much too fast for that. The quantity taken for the sample was quite a large one; and he believed the system was one which had commended itself to the collieries. There were very few disputes about it, and the collieries obtained particulars of the results. Indeed, in many cases this was the only way they knew what coal they were producing. He had not made a contract for coal by which payment was made on the basis of quality; but a great deal of information had been collected on this matter. Mr. Reavell had also said that it was the buyer's fault that he did not get the right stuff. But, again, he could only say that if no one was making what they wanted, they had to put up with what they could get. He was interested in Mr. Jockel's figures, because they were worse than his own. Mr. Patchell had spoken about several interesting subjects, and especially the knowledge of the people who came to sell things.

Captain SANKEY, at the conclusion of the discussion, asked if it were the opinion of the meeting that the British Standards Association should be asked to appoint a Committee to deal with the standardization of dimensions of firebricks, and the errors permissible in these dimensions.

Prof. J. W. HINCHLEY remarked that he happened to be Chairman of that Committee.

Captain SANKEY said he had specially asked whether there was such a Committee, and had been told there was none. He hoped, however, that the Committee would be successful in standardizing these dimensions.

A NEW HOLDER AT CROYDON.

THE holder here illustrated, which has recently been completed for the Croydon Gas Company, is a four-lift one, and is contained in a brickwork tank 226 ft. diameter face to face of the stones to which the tank-guides are fixed. The total depth is 46 ft. 3 in., and 45 ft. to the rest-stones from the coping level. The dimensions of the lifts are as follows:

		Water Gauge.
Inner lift	214 ft. 9 in. dia. × 45 ft. 0 in. deep;	pressure thrown = 4·6 in.
Second lift	217 ft. 6 in. ,, × 45 ft. 0 in. deep;	,, ,, = 2·6 in.
Third ,,	220 ft. 3 in. ,, × 44 ft. 9 in. deep;	,, ,, = 2·5 in.
Outer ,,	223 ft. 0 in. ,, × 44 ft. 9 in. deep;	,, ,, = 2·1 in.

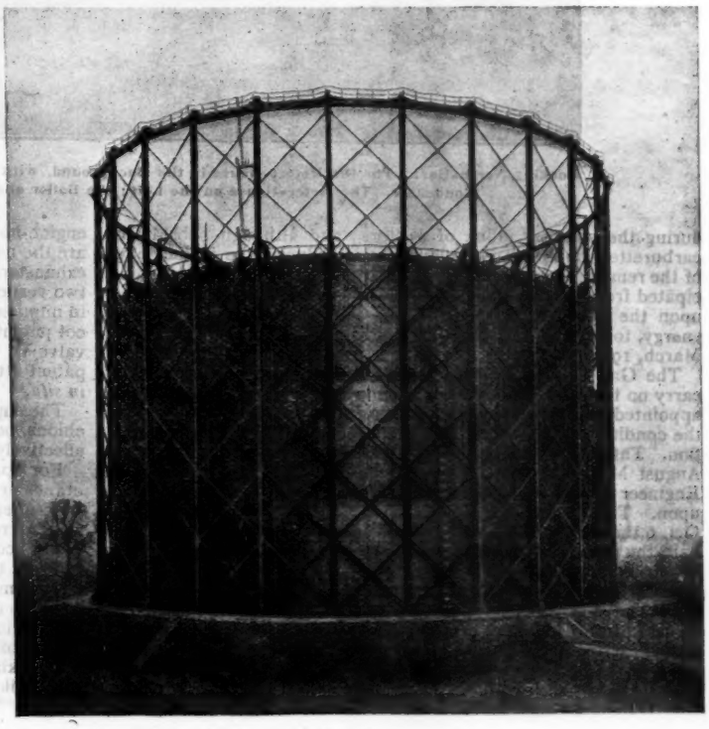
The guide-framing, which consists of 28 heavy plated standards each 181 ft. high, together with the whole of the heavy diagonal bracing and top tier of girders, was erected tier by tier from the crown of the holder (which was kept inflated with air to the necessary height as the erection proceeded), by means of a luffing derrick travelling upon a single line of rail secured to the second row of crown plates, while the steam winch and boiler travelled on the crane track round the tank on the ground.

The holder is now being fitted with a new type of patent apparatus known as the "H.P." anti-freezer, of which there will be two sets to each cup. The chief feature of this system is that, whatever the position of the holder, there is no possibility of water-logging of the pipes, which can be efficiently drained at the bottom; and steam need only be turned on when there is actually severe frost.

The total complete weight of the holder, including the tank-guides and framing, which is of steel throughout, is 2398 tons, and the total capacity is 6,876,000 c.ft. Some idea of the magnitude of the structure may be gained from the fact that, when the holder is fully inflated, the top of the crown stands over 208 ft. above the surrounding ground level, and is the great landmark of the district. It also bears testimony to the rapid growth of Croydon, the population of which has more than doubled during the last twenty years. It is, perhaps, also worth mentioning that this holder is the largest one yet built in the South, outside London.

The work of erection was commenced during December, 1914, and continued until early in 1915, when work was stopped owing to the exigency of the war. The work then completed was the tank-framing and the two outer lifts. A portion of the crown sheeting was also laid upon the crown framing. Work was not re-commenced until July, 1919; the whole structure being completed ready for gas during October last year.

The Directors of the Croydon Gas Company and Mr. Archibald Caddick, their Chief Engineer, are to be congratulated upon the acquisition of so fine a piece of engineering work, which was carried out to the designs, and under the direct supervision, of Mr. Caddick and his chief constructional engineering assistant, Mr. Frank J. Harrisson, and erected by Messrs. Ashmore, Benson, Pease, & Co., Ltd., of Stockton-on-Tees. The tank was constructed by Messrs. Thomas Vale and Sons, Ltd., of Stourport.



GAS-WORKS RECONSTRUCTION AT LLANDUDNO.

MANY gas undertakings felt the inconvenience of the restriction put upon their contemplated work of reconstruction and development by the exigencies of war-time financial conditions. Perhaps in no case was the resulting difficulty of maintaining an effective service more apparent than in the popular "Queen of Welsh Coast Resorts"—Llandudno.

As far back as the year 1913, the necessity of extending the productive capacity of the gas-works was realized. But the measures adopted at the time were sufficient for a short period only, and in 1915 a further development of retort-house plant was recommended to the Town Council, but owing to financial and other war-time restrictions) could not be carried out. From that time onwards to 1920, the Gas Committee and their Gas Manager experienced ever-growing trouble with a works which had more than once been described as a "scrap-heap," with plant too small for a rapidly-growing demand, and also suffering from the ravages of time. The task of keeping up the supply of gas was a most difficult one, and must have occasioned the Manager many sleepless nights.

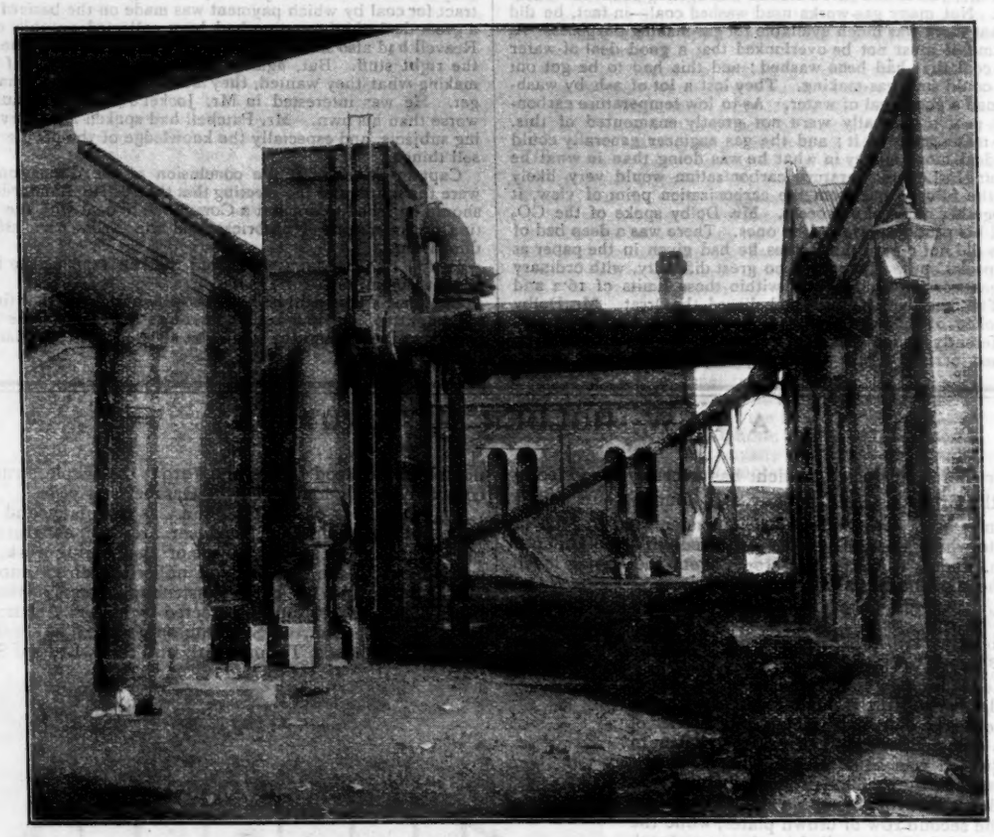
Low-water mark was touched in the seasons of 1918 and 1919, during the summer influx of visitors; and although subsidiary carburetted hydrogen gas plant was introduced, the inefficiency of the remaining plant prevented the realization of the relief anticipated from its adoption The severity of the strain told heavily upon the Manager (Mr. Alpin M'Gregor), who, with unsparing energy, toiled day and night to avert disaster, until his death in March, 1920.

The Gas Committee engaged Mr. J. C. Belton, of Chester, to carry on the undertaking until a successor to Mr. M'Gregor was appointed. They also requested him to make a full report upon the condition of the work, and prepare a scheme of reconstruction. This report was presented in May, 1920; and the following August Mr. Belton was appointed by the Council as Consulting Engineer to carry out the work of reconstruction then decided upon. The actual work was commenced in January last, and by Oct. 6 the whole of the plant was in full operation.

In the retort-house the retort-bench has been extended by the construction of an additional bed of eight through retorts. Three other beds have been rebuilt from the foundation; and the main arches have also been rebuilt. A new foul-main has been constructed from the retort-house to the new water-cooled condenser, and is carried on light steel lattice standards about 18 ft. high.

The site for the new plant presented foundation problems, as it was formerly a clay-pit for some neighbouring brickworks, and had been filled-up some years ago with town's refuse. By means of substantial reinforced concrete rafts, a good foundation for the new buildings has been provided; the latter—consisting of boiler-house and engine and exhauster house communicating, also meter house—are built of red brick, having steel roofs covered with "Fibrocement" corrugated sheeting. The sills, heads, and copings are all of reinforced concrete. The floors of the engine-house and meter-house are well above the concrete raft, and consist of cast-iron gratings supported on steel joists, affording easy access to the interior work below the floor-line. The buildings are roomy, well ventilated, and sufficiently high to allow of overhead operations being conducted without difficulty. The boiler-house is built to accommodate two 30 ft. by 7 ft. 6 in. Lancashire boilers, one of which is already installed and at work. From this boiler a steam main is carried across the old portion of the yard to the carburetted hydrogen gas plant, which has been served hitherto from a new Cochrane boiler installed in 1920. The above-mentioned steam main will enable the supply of steam for the whole works to be taken from either boiler.

The engine-house contains two sets of engines and exhausters, with bye-pass, governors, valves, and automatic lubricators. The pressure-gauges connected to the whole of the plant are in the engine-house, and are of the Thomas type; and, in addition, there are the usual recording gauges and jet photometers. From the exhausters the gas passes to a Livesey washer, and thence through two vertical rotary Feld washers to the purifiers, which are four in number, each 30 ft. by 25 ft. by 5 ft. deep, provided with Bearscot patent unit reversing valves and rubber jointing. The centre-valve is of the Weck type, being also provided with Bearscot patent fittings so that the valves can be ground on to their seats *in situ*.



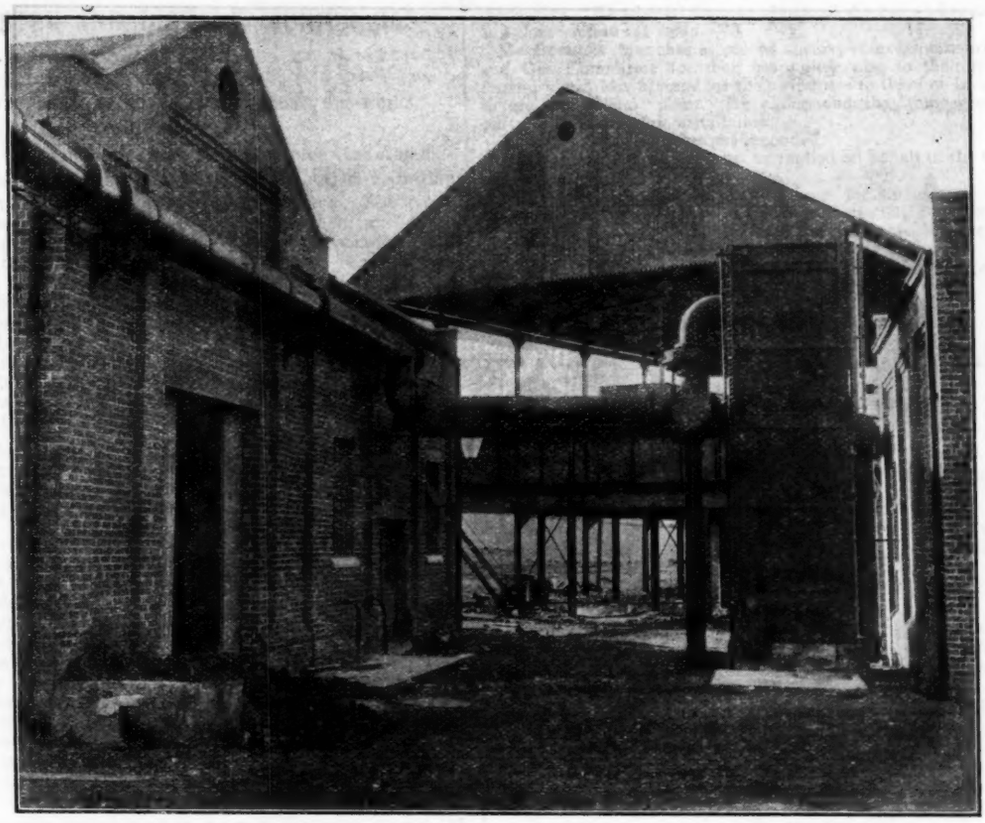
Looking North-East. The Old Retort-House in the Background, with the New 18-in. Overhead Connections to the Condenser. The Meter-House on the Left; the Boiler and Exhauster Houses on the Right.

The supporting structure is carried on thirty steel joist stanchions, bolted to reinforced concrete bases, by which the load is effectively distributed.

For operating the covers of the purifiers two Hovey travelling cranes are provided; and on these again are mounted four swing jib-cranes for lifting oxide from the ground level. The steel-framed roof of the purifier structure is covered with "Fibrocement" corrugated sheets.

From the purifiers the outlet main is carried overhead to the station-meter house already mentioned. The new square-cased meter is of the Gas Meter Company's well-known pattern. The connection from the new meter to the holder inlet was made by means of the "under-pressure" method without interruption of gas-making, which was at the time proceeding in the old plant.

A striking feature of the new works is the carrying of all the

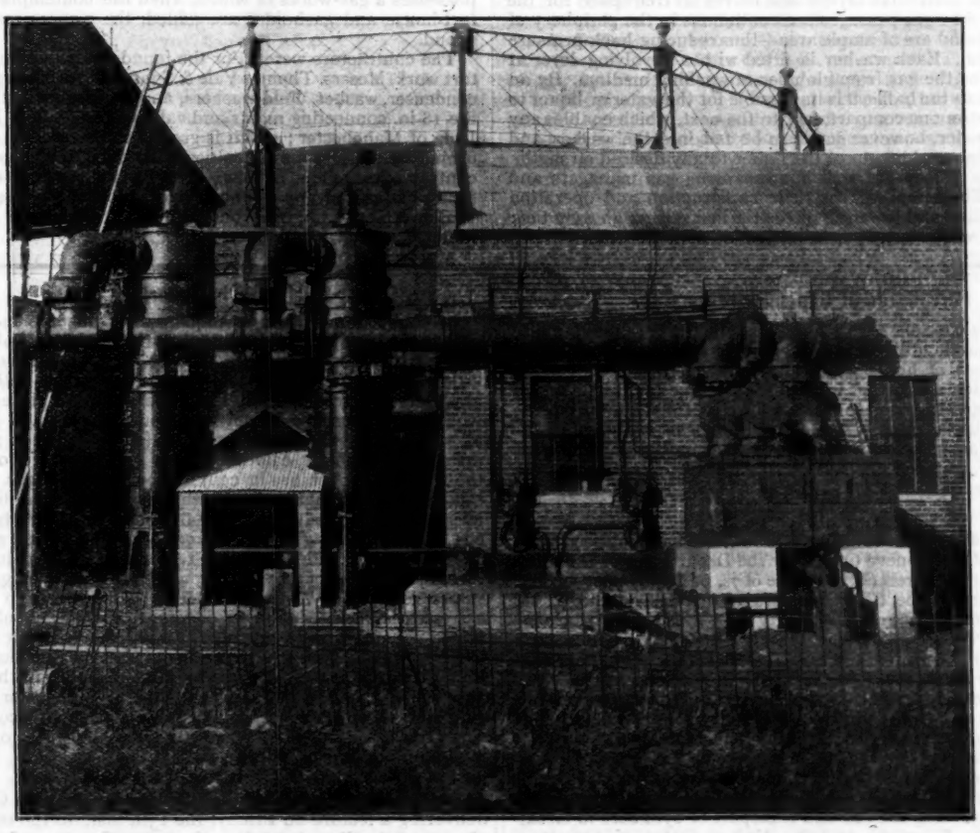


Looking South-West. The New Purifier-House in the Background. The Boiler and Exhauster Houses on the Left; the Condenser on the Right.

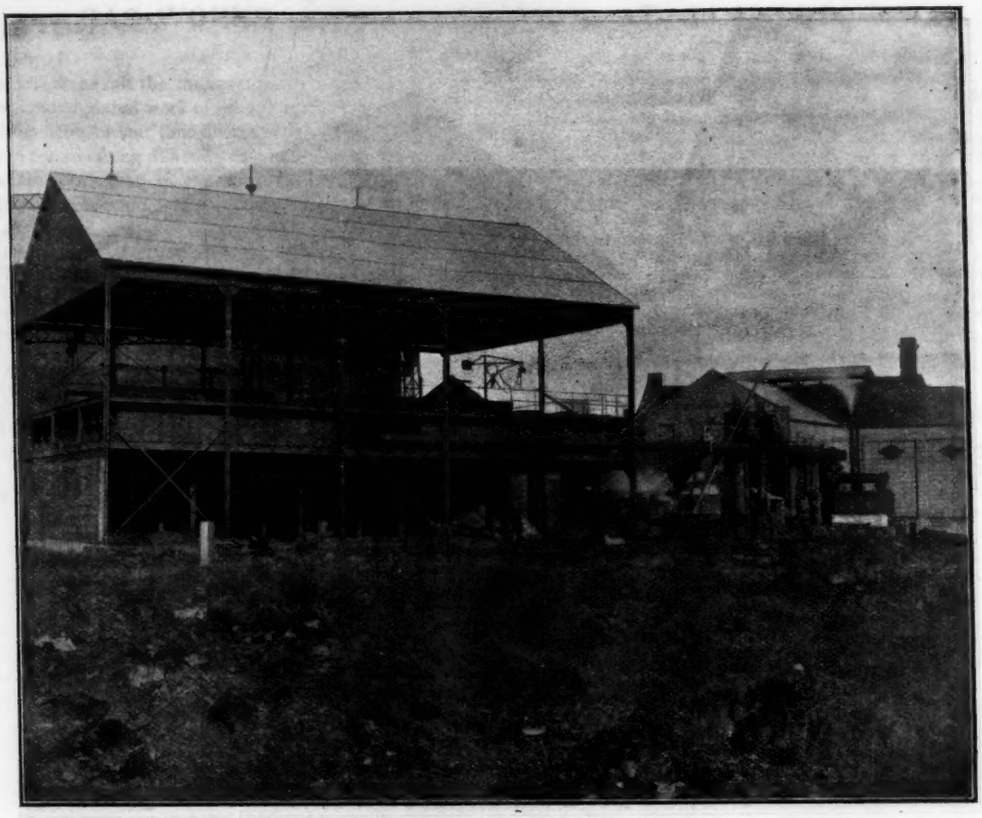
outdoor connections well above ground on stanchions. Each unit of plant is furnished with a bye-pass; all the valves having lettered indicators which can be easily read from the ground.

The exhausters are of the four-blade type, to pass 60,000 c.ft. of gas per hour; and all the plant is constructed to this standard, with a view to the rapidly-growing demand for gas for lighting, heating, cooking, and power purposes. The steadily increasing output of the last three years, and the building developments in progress and in prospect, necessitated the provision of adequate capacity in the new plant to meet all requirements for some years ahead.

The pair of Feld vertical rotary washers call for particular



View from the Macadu Road. The Livesey and Feld Washers, Pumps, Tar-Separator, &c.



General View from the Maesdu Road, showing the Hovey Cranes and Jib Cranes on the Purifiers, &c.

notice, as they have special novel features. The main shaft running up the centre of the washer is arranged to be almost frictionless, as it is suspended on spherically seated ball-bearings. There is no other contact between the shaft and machine except at the bottom of the washer, where it passes through the usual gland. The cones that are used for lifting and spraying the water or liquor in the washers are spun and mounted on properly centred hubs. Consequently, the water is sprayed right across the washer in horizontal layers, and leaves no free space for the gas to slip. The gas passages are continuous in the periphery of the machine, and are of ample area—thus reducing back-pressure to a minimum. Each washer is fitted with a revolving dryer at the top, to free the gas from globules of washing medium. By an arrangement to the baffle, it is impossible for the water or liquor to be sprayed from one compartment to the next, which enables any quantity of water, however small, to be fed into the washer, and the consequent working-up of the liquor to any desired strength.

The Hovey cranes are well known among gas managers and engineers. The simplicity of their construction and operation makes the lifting and lowering of the purifier covers an easy task for one man, without any fear of distortion of the covers.

Provision for tar and liquor storage has been made by the conversion of a disused gasholder tank 48 ft. dia. by 17 ft. deep. This has been covered-in with reinforced concrete carried on rolled steel joists and cast-iron stanchions, and not only affords much needed storage, but conveniently enlarges the area of the coke-yard.

The general arrangement of the new plant is very compact and convenient; and it is not too much to say that Llandudno now possesses a gas-works of which, when the contemplated new retort-house and gasholder are added, the owners may justly be proud.

The contractors were: For the foundations, buildings, and retort work, Messrs. Thomas Vale & Sons, Ltd., of Stourport; for the condenser, washer, Feld washers, and purifiers and structure, and the 18-in. connecting mains and valves, Messrs. R. & J. Dempster, Ltd., of Manchester; and it is greatly to the credit of these two firms that, despite the difficulties of the times, they completed their contracts to schedule time. The exhausters and engines and steam-mains and connections were supplied by Messrs. George Waller & Son, Ltd., of Stroud, and the station-meter by the Gas-Meter Co., Ltd., of Oldham.

Percentage of Expenditure for Gas.

Less than 7 p.ct. of the average yearly income of Ohio families is spent for public utility service, according to figures compiled by the department of home economics of Ohio State University. The compilation shows that in 1920 the average family having an income of $1500 to $6000 spent only 6·49 p.ct. of the total income for public utility service. The expenditures, as analyzed in the survey, were as follows: 1·01 p.ct. of the families' income went for electricity, 2·27 p.ct. for street-car fare, 2·45 p.ct. for gas, and 1 p.ct. for telephone.

Gas Cylinders Research Committee.—There has just been published by H.M. Stationery Office, for the Department of Scientific and Industrial Research (at the price of 7s. 6d., or by post 7s. 9d.), the first report of the Gas Cylinders Research Committee. It consists of a majority and a minority report, and gives the conclusions and recommendations of the Gas Cylinders Research Committee on the types of gas cylinders which should be employed for the storage and transport of compressed gases which are not in the liquid state in the cylinder. Appendixes to the report include full reports on tests made at the National Physical Laboratory on cylinders of high-carbon steel subjected to varying heat treatments, and on very light steel cylinders made for the Royal Air Force during the war; a summary of the evidence given by witnesses before the Committee; a summary of the regulations governing the use and transport of cylinders in Great Britain, France, Germany, and the United States of America; and a note on the deviations of technical gases from Boyle's Law.

Variation in Calorific Value.

In connection with their inquiry regarding the most suitable calorific value of gas to be supplied, the Michigan Public Service Commission said that, "with proper operation, there should be little variation in the calorific value of gas when both water gas and coal gas are made in the same plant. It is evident that where coal is received from numerous sources, and those coals all vary in gas-making properties, it is impossible at all times to maintain a constant calorific value; but by careful operation of the water-gas machines in conjunction with coal-gas equipment, this variation should be kept within extremely small limits. The average heating value to be maintained may vary from 450 to 625 B.Th.U., with different degrees of economy and efficiency in operation, depending upon the raw materials used in manufacture, the process of production, and the quality of gas the consumer requires. Whatever calorific value between these two extremes is decided upon as proper, that value should be maintained constantly with but slight variation. It is not the high or low heat value of the gas that reflects poor service, but the variation in that value. A rate can be fixed, fair both to the company and the consumer, based upon a low or high calorific content gas; but a rate cannot be equitable under any consideration when the calorific value of the gas varies between too distant a minimum and a maximum."

Mr. S. B. Chandler, of the South Suburban Gas Company, is delivering a lecture on Friday, the 13th inst., to the staff and employees of the Telephone Manufacturing Company, Ltd., at West Dulwich, taking for his subject "A Piece of Coal."

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Visit to the "Pleno" Plant at the Higginshaw Gas-Works, Oldham.

Members of the Manchester and District Junior Gas Association visited the Higginshaw Gas-Works, Oldham, on Saturday last, to inspect the "Pleno" plant installed there. The party (some 100 in number) were received by the Engineer and Manager, Mr. T. Duxbury (an hon. member of the Association), and conducted to the plant by way of the retort-house. In welcoming his guests, Mr. Duxbury expressed his keen interest in all juniors, and his full confidence in the rising generation. He introduced Mr. George Helps, and asked him to give a few notes on the "Pleno" plant.

Mr. GEO. HELPS (Nuneaton) said that Oldham had taken a great part in the question of low-grade gas. They had taken the lead in a question that would eventually benefit the whole country. He then read a paper which follows this report.

At the conclusion of Mr. Helps's remarks,

Mr. DUXBURY described the working of the plant by means of a diagrammatic sketch, and pointed out, on the plant itself, the various details connected with it.

"PLENO" PLANT.

The plant has a capacity of 2 million cubic feet of 150 B.Th.U. gas when coke is used, or 200 B.Th.U. with coal. The plant consists of coal elevator and overhead conveyor and hoppers, eight steel generators, brick-lined, four superheaters, two retort-house governors, and complete sampling and testing plant, consisting of four miniature exhausters, pressure gauges, three recording calorimeters, Orsat and flame board. The process of gas making is continuous—no running or blowing—air and steam being drawn in through the superheaters.

The "Pleno" gas is mixed with 550 B.Th.U. straight coal gas immediately outside the retort-house; no gasholder being required.

"PLENO" GAS-FIRED BOILER.

This Lancashire boiler is 28 ft. by 7 ft. diameter, by 100 lbs. working steam pressure, and is fitted with six "Pleno" burners. The boiler has not yet been set to work; but it is intended to carry out extensive experiments with both ordinary street gas of 400 B.Th.U., as well as "Pleno" gas of 150 to 200 B.Th.U.

The following results were given by Mr. Duxbury:

APRIL 20, 1921, TO DEC. 29, 1921.

Total gas made	123,016,230 c.ft.
Coke used	933 tons
Gas made per ton	131,800 c.ft.
Average calorific power	137·6 B.Th.U.

These figures include all stoppages for play shifts, inferior and wet coke, and two months of coal strike.

STRAIGHT "PLENO" GAS—NO AIR.

Gas made per ton	124,138 c.ft.
Average calorific value	139·43 B.Th.U.
B.Th.U. multiple per ton of coke	17,317,250

STRAIGHT RUN FROM AUG. 3, 1921, TO AUG. 18, 1921.

Make per ton	121,662 c.ft.
Calorific power	155 B.Th.U.
Multiple	18,858,610

STRAIGHT RUN FROM AUG. 23, 1921, TO AUG. 30, 1921.

Make per ton	164,500 c.ft.
Calorific	130 B.Th.U.
Multiple	21,385,000

No play shifts.

Mr. DUXBURY gave a few of the reasons why he had adopted the "Pleno" plant, viz.: Low working costs, lower capital costs, low cost of maintenance, that it was a continuous process, there was no chimney, no smoke, also it was a coal conserver. The Oldham Gas Committee were very enterprising, and were now experimenting with gas as a means of firing the Lancashire boiler, as there was room for plenty of improvement. They would use something like 50,000,000 c.ft. per annum were boiler firing by gas adopted in Oldham. Further, they were out for an all-year-round load; and if low-grade gas was successful, they felt it would be an advantage to lay a special trade gas-main on the same lines that they had laid a special trade water-main. Then the atmosphere, which had at the moment some 400 to 500 chimneys pouring out smoke into it, would be very much clearer if they did away with the smoke, and adopted gas firing for their mill boilers.

TEA AND A DISCUSSION.

After the inspection of the plant, the party were conveyed by a special tram to the Town Hall, where they were entertained to tea, and given a civic welcome by the Mayor of Oldham (Alderman Houghton, J.P.), accompanied by Messrs. Bardsley and Pollard.

The MAYOR, in extending a hearty welcome to Oldham, remarked that the town was noted for its thrift. Hundreds—yes, thousands—of their people were living in their own houses. He congratulated the members of the Association in the way they had banded themselves together for a definite purpose. Some people had an idea that gas was declining; but from the visit they had had that day, he thought it would not have been in vain. He paid a high tribute to the Oldham gas officials, and gave instances of his early days when they, as apprentices, formed a small society for the reading of a 1s. book of mechanics. He advised them to obtain all the knowledge they could, and then send it out again.

Mr. BUCKLEY (Manchester) moved a hearty vote of thanks to the Mayor and Gas Committee for their hospitality, also to their friends Mr. Duxbury and Mr. Massey for their kindness to them in inviting them to see the "Pleno" plant. He understood that they were the first party to be shown this installation.

Mr. APPLEBEE (Manchester) seconded.

Messrs. POLLARD and BARDSLEY replied on behalf of the Gas Committee.

After tea, the meeting was thrown open for an informal discussion on low-grade gas, in which Mr. George Helps led, and the following gentlemen took part: Mr. Carter (Liverpool), Mr. Sissons (Flixton), A. L. Holton (Manchester), W. H. Battersby (Bury), J. T. Haynes (Bolton), W. Buckley (Manchester), W. T. Jones (Widnes), H. Goodier (Runcorn), J. Albinson (Manchester), and A. Hodgson (Newton-le-Willows).

NOTES ON "PLENO" GAS PLANT AND PROCESSES.

By GEORGE HELPS.

[A Paper read before the Manchester and District Junior Gas Association at Oldham, on Jan. 7.]

"Pleno" gas may be made in many ways. Popularly speaking, "pleno" means abundance, and "pleno" gas means plenty of gas and heat energy for your money—cheap gas. The quality of "Pleno" gas when not made by the complete gasification of coal is about 400 B.Th.U. (gross).

Until quite recently, rich gas made by a costly process has been distributed in our towns. So rich is gas made by the ordinary methods that consumers cannot completely burn it at ordinary pressures in ordinary appliances. Very considerable waste, bad smells, and the blacking or sooting-up of ceilings, &c., is the result of its use. "Pleno" gas is a less rich, but a freely burning, gas. To make rich gas, only the rich parts of the coal are used. The coke—about 10 cwt. from each ton of coal—remains over. There is just about as much heat energy in coke as there is in coal, weight for weight. "Pleno" processes set out to use just as much of the coke gas mixed with the rich coal gas as the consumers desire, or to make a freely burning clean gas by various means that the "Pleno" processes or modifications of them cover. The "Pleno" processes, plants, and appliances are, it may be said, covered by patents.

My original suggestion in 1916 was that gas should be distributed at a quality of 350 net, 400 gross; and that this would do (roundly) in many uses just as much work as a 500 or 550 gas. Since that time experience has taught me that 400 gas is far richer than it has any need to be for town's purposes, and that a quality much less in calorific value is quite suitable for the purpose, and costs much less. I am using now a quality of 250. The determining factor of quality is the discovery of the lowest quality of gas in B.Th.U., together with its composition, which will fulfil all the requirements of the domestic consumer. This discovery can only be made by practice on a large scale. A low-quality gas need not contain high inerts—water gas, for example; but, generally speaking, cheap low-grade gas means high inerts. Therefore if I were asked to name the cheapest system of gas manufacture for town's purposes, my answer would be that system by which was produced the greatest number of B.Th.U. from a ton of coal in gas of a quality fulfilling all the requirements of the domestic consumer (the industrial user can look after himself), and at the least cost for labour, capital, and distribution.

In the light of present knowledge, gas obtained from the complete gasification of coal in closed vessels without chimneys would appear to be by far the cheapest system so far as the cost of B.Th.U. is concerned. Such a system is likely to be found, if not already found, to be embraced in some glorified form of producer or complete gasification plant, or so it seems to me. The Fuel Research Board in their report said producer gas may be the cheapest source of heat energy to produce, but qualified it by saying "it is the most expensive to distribute over a wide radius." This distribution difficulty is not so great as it appears. The more this difficulty is tackled, the simpler will it become.

The only ground, in my opinion, on which to-day any restrictions as to quality, inerts, or composition of gas could be well founded would be that concerned with the establishment of its ability to retain a stable flame. In my view the manufacture of the cheapest and generally most serviceable gas that can be produced from coal by a simple one-stage process of gasification, whatever its quality or composition, will not in the long run prove to add appreciably to the costs of distribution. I cannot conceive that the quality of gas which will be found the most suitable for all purposes, and which can be manufactured at the least cost, is likely to possess any serious disabilities; and certainly the cost of delivery (sending it home) will not be a bar to its adoption.

A simple way of making "Pleno" gas is to dilute straight coal gas with blue water gas, producer gas, &c. The Oldham plant, you see, is a form of simple apparatus for producing a glorified or rich coal producer gas. Its object is to make a gas for diluting the rich, straight gas made in the adjoining retort-house. In this plant, from one ton of good coal we know that we can make 20,000,000 B.Th.U. in a quality of gas approximating to 200

B.Th.U.; but we have not satisfied ourselves as to the cost of doing it. The strike in the summer largely upset our work; and we have not made any further experiments since last April or May. When the heavy work of the winter is over, our experiments will be renewed. I should have preferred your visit to have taken place when we could have given you more facts and figures; but Mr. Duxbury was anxious that you should make your visit now.

The plant is worked on suction; and in winter the existing exhausters will not give us the power we require to get the gas away fast enough. We are remedying this.

To Make 400 B.Th.U. Gas by Dilution.

If we take straight coal gas of a quality of 600, and a make of 10,000 c.ft. per ton, and a make of 20,000,000 B.Th.U. per ton by this plant of a 200 quality, and mix the two, we should have the following result:

1	ton of coal 10,000 c.ft.	of 600	= 6,000,000
1-10th	,, ,, 10,000	,, 200	= 2,000,000
	20,000	2)800	= 8,000,000
		400	

20,000 c.ft. of 400 gas or 8,000,000 B.Th.U. from 1 1-10th tons of coal, or (say) 18,000 c.ft. of 400 mixed gas per ton of coal, and roundly the same bye-products—coke, tar, and liquor—as when making straight coal gas. In my view it is much simpler and cheaper to make 400 gas in this way than by diluting with blue water gas.

To my mind this method of bridging-over the period between straight coal gas making and the adoption of complete gasification processes has much to recommend it. There is no doubt that complete gasification in some form or other will be the manufacturing process of the future. The simplicity with which straight gas can be diluted to a predetermined and constant quality is apparent. The resultant gas is freer from impurities than straight coal gas, is cleaner in use, naphthalene troubles cease, and the consumers find that 400 gas made in this way is much more easily adjusted, and is more efficient than richer gas in most of their existing appliances.

It must be remembered that ordinary producer gas of 140 or so is quite suitable for all lighting and power purposes on a gas-works. A considerable saving can be made by its use. The South Metropolitan Gas Company make 7,000,000 B.Th.U. in straight coal gas per ton of coal. The dilution of this gas would give the consumers many advantages.

To Make 250 Gas by Dilution.

Taking 250 gas as that to be distributed, we have the following figures:

			B.Th.U.
Straight coal gas, 1 ton of coal	10,000 c.ft.	of 600 =	6,000,000
12 cwt.	60,000	,, 200 =	12,000,000
Mixture	70,000	of 257 gas =	18,000,000
1 of 600 gas =	600		
6 of 200 gas =	1200		
7	7)1800		
	257		

70,000 c.ft. of gas from $1\frac{1}{20}$ tons and 10 cwt. of coke left represent per ton of coal:

32·20 = 70,000 . ·. 20·20 = 43,750 c.ft. of 250 gas per ton.
10,937,500 B.Th.U. and $6\frac{1}{4}$ cwt. coke per ton of coal used.
(32·20 = 10 cwt. . ·. 20·20 = $6\frac{1}{4}$ cwt.)

In the mixture of 43,750 c.ft. of 250 gas, there is 1·7th by volume of straight coal gas and 6·7ths of "Pleno" gas.

1-7th	of 43,750 =	6,250 c.ft. of 600 =	3,750,000 B.Th.U.
6-7ths	,, =	37,500 ,, 200 =	7,500,000 ,,
			11,250,000

The actual mixture would be 257 quality. Hence the difference in figures.

Weight of coal:

		Cwt.
1-7th	of 20 cwt. used in making straight coal gas =	2·85
6-7ths	,, 20 ,, ,, ,, "Pleno" gas =	17·1
		19·95

Now it will be seen that by mixing "Pleno" gas with straight coal gas we obtain in 250 quality 11,250,000 B.Th.U. per ton of coal and have left $6\frac{1}{4}$ cwt. of coke. What is the obvious thing to be done with this $6\frac{1}{4}$ cwt. of coke? Can it be sold for more money than it would be worth were it converted into gas? This plant (the Oldham "Pleno" plant) is a bridge between the making of straight coal gas in ordinary horizontal retorts and complete gasification.

We (the "Pleno" people) also have another form of a complete gasification plant which is a development of the plant before you, in which 250 gas may be made (and if necessary a richer quality), so that the retort-house may be done away with altogether. We shall shortly have these plants at work; and we shall look forward to meeting you in the near future to inspect them.

I am convinced (and my conviction is based entirely on experiments on a large scale) that 20,000,000 B.Th.U. from a ton of ordinary good coal may be obtained in a serviceable and economically distributable gas, and that such a gas can be made at such a price that three times the therms now made by ordinary processes can be sold for the same money. The prices ruling to-day are far too high, and are responsible for the smallness of the load factor that all gas undertakings have. Cheap gas means more trade and less unemployment.

With these remarks as to the plants for making low-grade gas that come under the "Pleno" system and processes, I would like to make a few observations on the efficiency of low-grade gas in general, and some of the factors in its cheap distribution.

I am often met with the argument that the distribution costs are 1s. per 1000 c.ft., and so on. People do not appear to realize that this 1s. is due to the load factor. If the mains are only used to their full capacity for one hour per day, how would such charges look if the full load, or something near it, was on for ten hours a day? Dear gas prevents this load—cheap gas will give it. The solution of the quality question is not to be found by a study of gas-making plants so much as by a study of the combustion of gas at consumers' appliances.

May I express, first of all, a few very elementary and fundamental facts concerning gas? Fundamentals are always so helpful.

What is gas? So far as coal gas is concerned, it may be looked upon as the fluid state of the solid coal. Gas is coal you can light with a match and put out by turning a tap. We know that in the gaseous state coal can be used in the minutest quantity that any particular requirement necessitates; while in its solid state coal may only be used in pounds at a time. If we could convert coal into its gaseous form without any cost for plant or labour, it is pretty obvious that there would then be no necessity to use it in its solid state. It could then be sold at the same price per unit in its gaseous as in its solid form.

It is now generally admitted that gas in most of its forms (straight coal gas, blue water gas, producer gas, &c.) will do all that solid coal will do. The only thing that militates against its general use for all heating and power propositions, industrial and domestic, is its cost. The domestic uses of gas, it might be said, are more important than the industrial; for it could be well argued that householders are entitled to the first consideration—not industrial users who could make their own gas, if they required a different or more costly gas than domestic consumers. As gas engineers we are just as concerned in the use of gas for the generation of electricity as in any of the more important industrial and domestic uses to which it may be put.

The cost of gas, heat unit for heat unit, should bear a very near relationship to the cost of the coal from which it is made. If coal costs £2 a ton, and contains 30,000,000 heat units, then 30,000,000 heat units in a gaseous form should be procurable by the consumer for something like £5. To-day 30,000,000 heat units in gas are costing the consumer £15 to £20.

On What Does the Cost of Gas Depend?

At present, in addition to the cost of coal, it is dependent on two other factors: 1. On the sale of coke, tar, and its bye-products, ammoniacal liquor, &c. 2. Of late years it has been very considerably affected by the so-called free supply of cooking and heating apparatus, fittings, &c., as well as the free maintenance of burners and mantles; or the provision of some services at very considerable cost, for which no charge is made.

To deal with the second factor first.

Free Work Means Dear Gas.

It is all very attractive to talk of service; but the main thing is to give the consumer cheap fuel in the form of gas, and to teach him how to use it in the best way. The costs of so-called service to-day are in some cases as much as, or more than, the cost of gas itself. The price charged for lighting gas, if the actual cost of the service given were to be added to it, would be such that few if any works in the kingdom could at present get their money back on it. Particularly does this refer to high-pressure street lighting. I do not hesitate to say that a service in many towns is given at no less a cost than that of 1s. per 1000 c.ft. on the whole of the gas sold. In other words, without this free work, gas could be sold in some instances at 1s. per 1000 c.ft. less.

Free work is never appreciated, and is and must be always unsatisfactory; for there is no check on the work done, or the material involved, as there is when all labour and goods are charged for. It is most unfair to the consumer who takes an intelligent interest in his own gas service, as well as to the industrial user who keeps his own apparatus in order.

Supply the consumer with cheap fuel and cheap and efficient appliances, and cut-out the free service of anything. Free work is no good to anybody. Beware of the man who will do something for nothing.

On What Should the Cost of Gas Depend?

Undoubtedly, it should be almost directly dependent on the cost of coal. The price at which coal B.Th.U. can be purchased in solid form, *plus* the cost of gasifying the coal in the simplest manner, *plus* the cost of works and mains upkeep, and *plus* reasonable profit, should be the selling price of gas. The gas-making undertaking should only provide plant and mains. The consumer should pay for the keeping in order of his heating appliances. He would soon be able to do all the work himself, if he could obtain satisfactory appliances and requisites.

Costs of services, meters, cookers, and the like, should not be allowed to be mixed up with those of the manufacture and distribution of gas. The effect of this is to saddle consumers with all sorts of charges in perpetuity that the fuel alone should not bear. Gas-works should be for the most direct and economical produc-

tion of gas in the simplest form possible—to put coal into mains in its gaseous form.

The Heating Value of a Gas.

The effective heating value depends mainly on these factors:

(*a*) The B.Th.U. contained in 1 c.ft. of the gas.

(*b*) The B.Th.U. completely consumed per cubic foot of the mixture of gas *plus* primary air issuing at the burner head.

[NOTE.—The hottest flame and therefore the most economical one obtained from any gas depends on one-stage combustion—the burning of a completely combustible mixture at the burner head.]

(*c*) The proximity of the flame to the object to be heated.

(*d*) The loss of heat through radiation, conduction, &c.

If gas of 500 B.Th.U. per foot be distributed, and only 350 B.Th.U. per foot out of them are completely consumed, and the others wasted by reason of their passing-out of the flame unconsumed, it follows that if 350 gas were distributed, and the whole of the B.Th.U. used, the less rich gas would do the same work as the rich gas. One B.Th.U. in a 500 gas will do no more work than one B.Th.U. in a 350 gas when the gas is completely consumed in each case. One B.Th.U. is as good as another.

Gas as it is supplied cannot be used by the consumer for heating purposes; he must add air to it in his burners. If he does not add the requisite amount of primary air in the proper manner, he wastes gas. To enable the consumer to add air, the gas must be supplied to him at his burner at such a pressure that the power at the nipple of his burner is sufficient to inject the necessary primary air. The burner must also be of such a type that after the necessary air has been added, the mixture of gas and air may be completely consumed on the burner-head, producing a coneless flame allowing close flame contact. When gas is supplied at pressures which will not inject the necessary air, or which will not burn a fully aërated mixture, a considerable distance must intervene between the flame and the object to be heated.

In comparing the heating efficiencies or flame temperature of gases of different qualities or compositions, each gas to be compared should be used in a manner which ensures the same degree of combustion taking place in each case. This degree, in my view, should be complete combustion in one stage. This is the only datum; and unfortunately very few burners allow of this.

Consumers' Burning Mixture.

I submit to you that, under the great freedom that the new Gas Regulation Act of 1920 gives us, the gas industry's only concern is with the mixture of gas, *plus* the necessary air for its complete combustion, that the consumer obtains at his burner-head. In other words, the only matter that counts is the consumer's burning mixture. We know that with a rich gas, free from inerts, the best burning mixture the consumer can have is one containing about 15 p.ct. of combustibles and 85 p.ct. of air. It is obvious, therefore, how many different qualities of gas may be sent from the works which would result in a flame of excellent quality for the consumers' uses. The most rational way to look at the distribution of gas is to consider the trunk main as the nipple of one immense bunsen burner providing a completely combustible mixture at its burner-head.

The next important matter to remember is that the complaint "bad gas" really means shortage of heat units completely consumed at the point of combustion (burner-head). [This was recently emphasized by Mr. M'Lusky, the Glasgow Gas Engineer.] Now this shortage is only due to one thing—lack of pressure. Most gas undertakings could very well double or treble their present works pressures to advantage. Whatever the quality of gas distributed, if the pressure at the nipples of burners is short the consumer has "bad gas." How many gas-cookers are there that, when in full use, are provided with a pressure of 30-10ths for rich gas? How many three-light slot-meters are there in use supposed to supply cookers using 100 ft. per hour? Do gas engineers realize that slot-meters have nothing like the useful capacity of ordinary meters? If these matters be considered for even a moment or two, it will be seen that it is these matters of distribution, and distribution alone, that indicate the quality of gas which should be manufactured.

A gas of 500 to 600 B.Th.U. requires, say, 5 volumes of air. A gas of 300 requires, say, 3 volumes of air. The pressure required with 500 to 600 gas to inject 5 volumes is about 30-10ths. The pressure with 300 gas is about 5-10ths. Here then is a compensating influence set-up in the case of low-grade gas.

The old axioms on the discharge of gas are: 1. The discharge of gas will be doubled when the length of the pipe is only one-fourth 2. The discharge of gas will be only one-half when the length of the pipe is four times greater. 3. The discharge of gas will be doubled by the application of four times the pressure. These axioms all have reference to very low pressures—say 5-10ths to 15-10ths. It will be found that when pressures go to 40-10ths and 50-10ths nothing like four times the pressure is necessary to double the discharge. In this connection too much thought is often given to the size of pipe, and too little to the taps and connections on it. The test of efficient piping is the pressure at the appliances the piping supplies when these are in full use.

For these reasons calculations for the discharge of gas through any main system should be made on the completely combustible mixture of the gas, and not the gas alone. Thus we arrive at the conclusion that the quantity of gas distributed through a system of main pipes depends on the volume of gas *plus* the volume of air for its complete combustion. It will be seen that the richer the gas, the more air it requires to form a completely combustible mixture, and the greater the nipple pressure required. With low-pressure systems, the discharge from a main depends on the difference in the initial and the terminal pressures.

To pursue the matter further. Assume 500 gas requires 5 volumes of air for complete combustion and 250 gas 2½ volumes of air. Further, assume that the 500 gas is free from inerts, and that the 250 gas contains 50 p.ct. of nitrogen. In the case of the 500 gas, the completely combustible mixture will be represented by 1 volume of gas and 5 of air—in all 6 volumes; and the 250 gas by 2 volumes of gas and 5 volumes of air—in all 7 volumes. So that for the development of the same number of heat units at the burner head in each case, the main has to convey to the nipple 2 volumes of gas in the case of the 250 quality. These two volumes only have to inject 5 volumes of air between them—2½ each. Thus the pressure required for this work may be hazarded to be something considerably less than that in the case of the 500 gas. It must be remembered that the 250 gas is heavier than 500, and the specific gravity approaches that of air; and thus the heavier gas is likely to inject the air more readily, due to its increased weight, and also to mix more readily with the air, due to its more equal specific gravity.

The pressure required to inject the air necessary for complete combustion in the case of 500 gas is stated as 30-10ths. The pressure required with 250 gas will not be more than 5-10ths or 6-10ths—probably less. If the initial or works pressure in the case of 500 gas is (say) 40-10ths, and the pressure required at the nipple 30-10ths, the difference in pressure on the main system is 10-10ths. Thus the difference in pressure between 40-10ths and 5-10ths, as in the case of the 250 gas, is 35-10ths. The main system, therefore, would convey the 2 volumes of gas required at the nipple with the same initial pressure.

Look at the matter in quite another way: In the case of 500 gas, the main system has to deliver to the burner head a completely combustible mixture represented by 6 units of volume. In the case of 250 gas the main system has to deliver in the form of a completely combustible mixture only 7 units of volume or 1·7th more, or (say) 15 p.ct.; and yet the calorific value of 250 gas is just half the quality of 500.

The Diagrams.

Diagram No. 1 represents one volume of 500 gas being supplied at the nipple of a burner consuming a completely combustible mixture at a pressure of 30-10ths with the burner in full use. We may assume that the gas-works pressure is 40-10ths. Say the burner is using 12 c.ft. per hour; then 6000 B.Th.U. are developed per hour at the burner head.

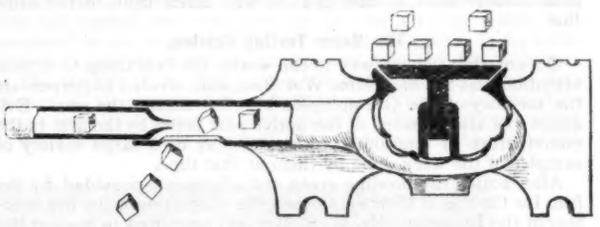


Diagram No. 1.

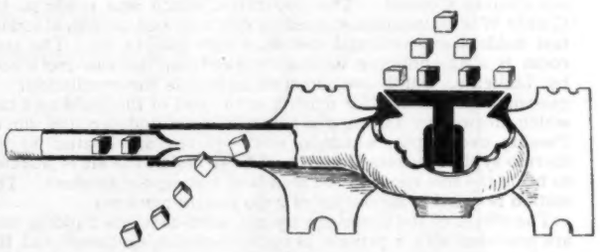


Diagram No. 2.

Diagram No. 2 represents two volumes of 250 gas supplied at the nipple (assume 50 p.ct. of inerts) of a burner consuming a completely combustible mixture at a pressure of (say) 5-10ths, with the burner in full use. We may assume that the gas-works pressure is still 40-10ths. To develop 6000 B.Th.U. per hour, the orifice of the nipple has to be increased in order to allow it to pass two volumes of 250 gas; and consequently the pressure drops. Though this quality of gas would produce a completely combustible mixture at the burner head with 5-10ths pressure, it would be found in practice that when the orifice was opened to pass twice the volume, such a big drop would not ensue. [Pleno, Ltd., have applied for patents to cover these matters of distribution.]

The only disturbing factor in this connection is the meter. If meters are to be run at considerably over their rated capacity, their absorption of pressure is considerably increased, and, to make-up for this for the time being, increased initial pressure may be necessary. Meter makers have already introduced a meter with larger valves and gas ways, so that increased duty is to be obtained from them.

These matters, I submit, are of the highest importance.

THE GOTHIC WORKS, EDMONTON, OF MESSRS. GLOVER AND MAIN, LTD.

Visit by the London and Southern District Junior Gas Association.

The new year opened in excellent manner for the Association, by a visit last Friday afternoon to the Gothic Works, Angel Road, Edmonton, of Messrs. Glover and Main, Ltd., where a pleasant and profitable time was spent in witnessing the various processes in the manufacture of the many specialities of Messrs. Thomas Glover & Co., Ltd., and Messrs. R. & A. Main, Ltd. Everything, of course, was in full operation; and there could have been little with which the visitors did not have an opportunity of making themselves at any rate to some extent acquainted. The Association had been over the works on two previous occasions—the last time having been in 1912; but in spite of this fact, they were urged on Friday to "come again soon." That this invitation will be taken advantage of in due season, there can be no doubt whatever, remembering the cordiality of the welcome always extended, and the attractiveness of the works to those connected with the gas industry.

As the total area of the buildings approaches 7 acres, a tour of inspection must of necessity take some time; and, as a matter of fact, there could have been few (if any) of the numerous small parties into which the visitors were divided who completed it in the two-and-a-half hours that had been allotted for the purpose. The arrangements made were of the completest, and the guides of the best; so that from start to finish everything went with absolute smoothness. On arrival, each member was handed an illustrated booklet, included in which was a key plan of the works, indicating the route to be taken during the inspection; and, in addition to this, arrows had been chalked on the ground, pointing out the right direction, at every spot where there was a possibility of a straggler otherwise going astray. The members, who were accompanied by the President of the Association (Mr. Frederick A. Frost), were received by Col. W. R. Glover (Managing-Director), Mr. Glover Clark (Director), and Mr. A. J. Crichton (Secretary); and they were also gratified to see among them during the afternoon Mr. A. E. Broadberry, of Tottenham. Without loss of time those present were formed into parties of ten, and shown over these new works of an old firm—for the business of Thomas Glover & Co. was founded in Clerkenwell as long ago as 1844. Continued growth of the business necessitated in 1900 removal from Clerkenwell to the large new works at Edmonton; and the subsequent enlargement of the old, and the introduction of new, departments are the result of a natural and individual development, and are not due to any extraneous circumstances—such as combination with other firms in the same line.

The Meter Testing Station.

On entering the gateway to the works, the first thing to attract attention was the handsome War Memorial, erected to perpetuate the memory of the 52 employees who fell during the war. Evidence was also afforded of the active part taken by the firm in the manufacture of munitions, by the display of a large variety of samples of the work done by them at that time.

After noting the bowling green and allotments provided by the firm for the use of their employees, the visitors were (by the courtesy of the Inspector, Mr. W. E. Barney) permitted to inspect the spacious and well-equipped gas-meter testing-station of the Middlesex County Council. The apparatus, which was made at the Gothic Works, includes sixteen 11 c.ft. and one 20 c.ft. standard test holders, experimental meters, King's gauges, &c. The test-room is a fine building, lighted by day from the saw-tooth roof by fanlights, which are movable outwards for ventilation. A gas-engine is installed for driving at the end of the building a fan, which draws its air supply through eight underground ducts. Passing over pipes, which in cold weather are heated on the thermo-syphon system from a coal-fired boiler, the air is warmed to bring the test-room to the standard testing temperature. The station is equal to an output of 2300 meters per week.

The offices of the Company are in a ferro-concrete building, and are provided with a private branch telephone exchange and the most modern office machinery. Among other labour-saving devices is a set of Hollerith electric tabulating machines, which dissect the costs of wages and materials by mechanical means. Small cards are punched with holes under various headings to correspond with the dissection required for cost purposes; a sorting machine next arranges these cards in any desired order; and they are then fed into the calculating machine which computes the various totals for transfer to the cost sheets.

Round the Works.

One of the first parts of the works to be visited was the brass foundry, in which are produced cast parts in brass, gunmetal, and white metal. The metal is melted in plumbago crucibles over a furnace sunk below the ground, and fired by gas coke with natural draught. Passing through the stores, the visitors saw an astonishing number of pieces of gas apparatus in various stages of completion. The stores run parallel with the railway siding along the front of the factory, and then turn at right angles into the works between the iron foundry and stove-fitting shop. This arrangement permits of all raw materials and supplies being loaded direct into the stores and foundry, and the issue and return of all parts direct to and from the different shops. The stores being continuous, and in immediate communication with every department, considerable economy is effected in handling and internal transport. The great extent of the stores is a striking feature of the works.

Emerging into the roadway, the tour was continued down the siding to the iron foundry. The siding is in communication with the Great Eastern Railway; and the shunting is effected by means of a petrol locomotive which was designed and erected in the firm's engineering shop. Before entering the foundry, the cupola for melting the metal and the lift for raising the necessary charges of iron and coke were seen. The capacity of the cupola is 20 tons per day. The firm have, of course, also a very large foundry at Falkirk, where hundreds of men are employed on similar classes of work. The complete process of moulding was witnessed, and it was learned that the Company make all their own moulding boxes. Over 1800 box parts, approximating to a total weight of 140 tons, are in constant use; and these involve in their turn the use of over 1000 plate and other patterns. In the making of the cores, no wires or core-irons are used; and the core, having fulfilled its function in the mould, can be poured out of the casting, leaving the inside clean and free from wires. Each casting is critically examined and sounded before being passed for stock.

Radiator tubes, owing to their being used in conjunction with steam under pressure, demand special treatment in the way of testing. The greatest care must be taken to see that a leaky or even a sound, but weak, casting does not find its way out. Each tube is therefore tested hydraulically in a specially designed machine. This machine is capable of providing a pressure of 120 lbs. to the square inch. The tube is placed on two plungers, which, by the movement of a lever, rise to press the tube into contact with two stops, which effectually seal the outlets. The tube is then filled with water, and the pressure raised to 60 lbs. as indicated on a gauge. The operator now looks for any stray jets of water or sweating of the casting. A lever is then shifted, which brings a differential piston into play, increasing the pressure to 120 lbs. to the square inch. This second severe test may reveal hitherto undiscovered flaws, or may open-out a thin place, showing that the core had shifted and weakened an otherwise good casting. A sand blasting plant is used for castings which require a specially good surface before being enamelled. Old castings are also cleansed of rust and dirt by this method.

In the power house were seen 90 B.H.P. and 60 B.H.P. gas-engines; and other gas-engines were observed in the different departments which contain machinery. In fact, gas is utilized in connection with a great number of processes throughout the works. It may be remarked, in this connection, that the yearly gas consumption is close upon 30 million c.ft., and that 3000 tons of gas coke are also utilized in the same period. In the pattern stores all patterns, whether general or special to the stove business, are booked in and out, and located in their respective lockers. Patterns can be traced at any minute; their movements being recorded by means of the card index system. The machines in the drilling shop were principally engaged on stove burners. Alongside this and the stove fitting shop run the stove department stores, which contain hundreds of tons of castings of stove parts. Near by are the warehouse and stove dispatch department, where the finished and tested articles are stored and prepared for sending away.

Every gas appliance as it leaves the fitting shops is taken to the testing and japanning shops, japanned or otherwise finished, and tested. The high degree of finish attained with gas-fires was remarked upon. This is a matter upon which the firm justly pride themselves. All apparatus is tested at a standard pressure of 2½ in. of water, unless otherwise required; the pressure being regulated by means of an 11 c.ft. test gasholder. The tester runs a lighted taper over all joints and connections; and any leak, as it lights-up in such dim surroundings, is easily detected. The burners are noted for any blind holes or faulty drilling; all movable fittings are removed and replaced, to ensure that the work has been done properly; and the burners are finally adjusted to give a perfect bunsen flame with a minimum of gas. A good deal of time was spent in the enamelling shop, where much interesting work was in progress. The class of enamelling carried out by the firm—on a really extensive scale—is what is variously known as majolica, vitreous, or porcelain, and is a highly technical process. There are two muffles which can accommodate large gas fires, and two smaller ones for parts. They are heated by means of producer gas. This is a side of the business which has been largely developed; and specimens of the work done were much admired. The smithy is equipped with three double forges, a pneumatic hammer capable of giving a blow of half-a-ton, and other tools.

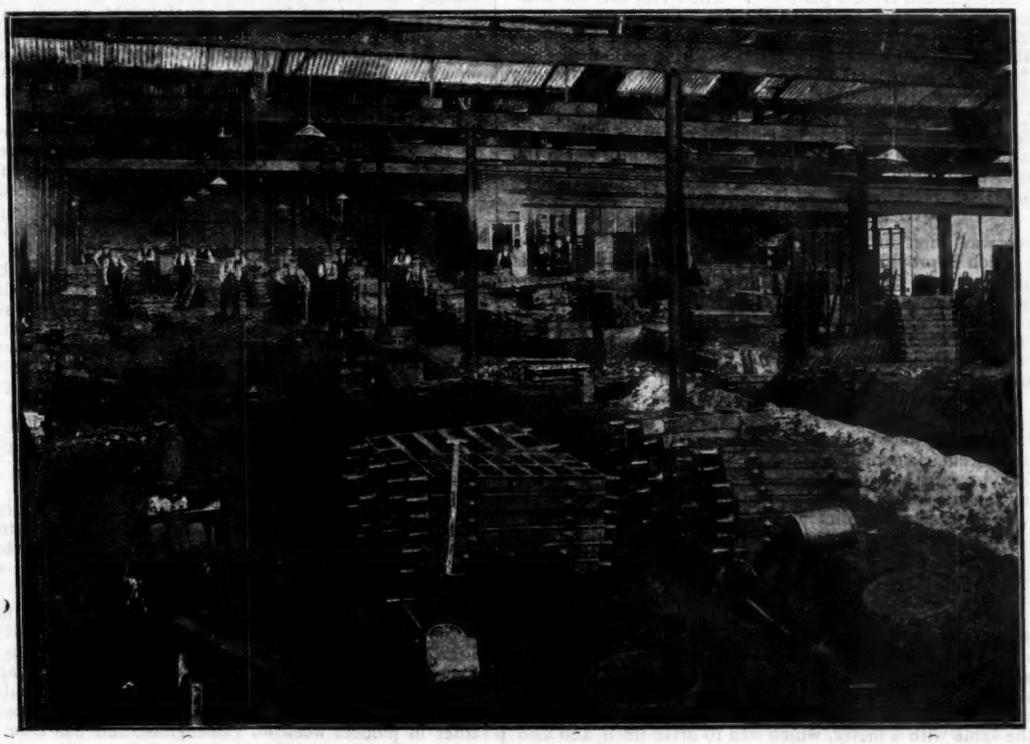
In the engineering shop, all special jigs and tools employed in the works are designed and manufactured. On the left-hand side there is an installation of small gas-engines and blowers for supplying high-pressure gas to various parts of the factory. In other parts of the shop are engineers' tools of every description—automatic gear tooth-cutting machines, milling machines, planers, shapers, slotters, radial and other drilling machines. During the war the shop was enlarged to three times its present size, in order to deal with Government contracts for making gun parts. The

SOUTH-EAST CORNER OF THE METER SHOP.

varied and valuable experience gained in their manufacture has been utilized with a view to increasing efficiency in the firm's normal equipment—notably in connection with the production of jigs and other precision devices which ensure accuracy and interchangeability of parts. Passing through the lamp shop, attention was arrested by a number of the well-known "Gothic" street-lanterns; and then in the stamp shop, amidst a formidable array of modern machinery, was seen an old-time drop-stamp set, which is still in use for various odd work that does not justify the expense of sets of tools requisite for use in a power press. Some meters require such large parts that a special steam-stamp is needed to produce them. A 250-light diaphragm, for instance, is about 2 ft. 6 in. in diameter, and requires two or three blows of a heavy falling tup-and-force, to shape it correctly; and, as this tup-and-force weighs something in the neighbourhood of 2 tons, a steam-boiler is requisitioned for the work. The steam under pressure, acting upon the top side of a piston in a vertical cylinder, lifts the force. The attendant then shifts the slide-valve to release the steam to exhaust, and the force falls with accelerating speed upon the work.

The First Reliable Dry Meter.

The various processes carried on in the leather shop were seen, and full explanation was given of the methods by which it is rendered almost impossible for an imperfect leather to be used. The shop devoted to the construction and repair of dry gas-meters is the largest of its kind in the kingdom; and in it were seen meters in all stages of manufacture and repair. Among these was a 1000-light meter (passing 6000 c.ft. of gas per hour), which is being entirely made by hand. The soldering-iron heaters which



A CORNER OF THE IRON FOUNDRY.

abound in this shop are all heated by high-pressure gas, and have been manufactured by the firm. In connection with this portion of the inspection, reference should be made to an interesting exhibit of types of every meter that has been made by the firm, right along from No. 1 to the present day. No. 1 meter, dated 1844, was labelled: "The first dry meter made by Thomas Glover and Co., Ltd., and the first reliable dry meter made by any firm." Near this, was one of the latest pattern prepayment meters, fitted with extra large cash-box. Another point worthy of mention at this stage, is the fact that members were introduced to Mr. T. Brown, who, after 62 years' service with the firm, still remains at his bench, in preference to retiring.

Time passed quickly in the brass shop, watching the rows of automatic and semi-automatic machine tools, all devoted to the manufacture of the various brass and white-metal parts that go to the making-up of an ordinary or prepayment gas-meter; and then there was a visit to the proving room. Each ordinary meter arrives at the test gasholders three times, and each prepayment meter four times, during the course of manufacture, for sounding, setting valves, testing prepayment valve (in the case of prepayment meters), and final testing for registration. In addition, before any meter is fixed, it is, of course, tested and stamped by the competent testing authority. The testing apparatus used in this department was made entirely by the firm, and includes 20 c.ft., 11 c.ft., and 1 c.ft. test holders, gauges, &c. In the spacious packing and dispatch shop, the meters are sorted-out in groups to correspond with the various motor lorry and railway routes. Thus, meters for towns in adjoining districts are to be found in the same group, and are automatically located preparatory to packing or loading-up in lorries.

The "Thackeray" Gas-Fire.

The final stage of the inspection was the drawing-office, chemical laboratory, and technical department, which contains calorimeters, radiometers, and various special apparatus for testing the efficiency of new ideas before they are embodied in the manufactured article. In connection with all productions, experiment and research are proceeding continuously. A gas-fire was seen under test for radiant effect, with bolometric apparatus. There was also in action a sample of the "Thackeray" fire, fitted with the Main trivet boiling burner. This new burner, it is claimed, satisfactorily fulfils requirements in a gas-fire boiling burner. These requirements are: Sufficient and rigid support for the kettle or pan, easily accessible, easily controlled, and conveniently situated. The burner must not interfere with the design of the fire, either for efficiency or appearance; and it is preferable that it should be completely hidden when not in use. The burner, injector, and pan must be in correct juxtaposition at all times. These points the Main burner has been designed to meet. A special combination cock gives independent control for fire and burner; each cock being clearly marked with its purpose, and being different in shape and feel. The burner (being in the centre, at the bottom of the fire) is definitely located centrally with the injector, and lined-up accurately with the pot-supports. By means of a loose top plate, the burner and supports are concealed, the injectors hidden, and all possible unsightliness removed. It cannot, in fact, be distinguished from a plain fire. The trivet lifts off complete, and allows instant access to the fire. One screw secures the burner. The whole of the fittings for the trivet are interchangeable. The same fuel plate serves either a plain fire or one with a boiling burner; and to convert a plain fire to a boiling burner fire, it is merely necessary to screw on extra cock to the injector, fix the small boiling burner by one screw to the fuel plate, and drop the boiling burner fender into position. The firm supply a fuel guard on novel lines, which effectually protects the fuel from being broken by the pan, and which lifts-off when not required.

Over-Driving of Gas-Meters.

A move was then made to the canteen and mess-room—a building which is provided by the firm for the men's use. It is under the men's own control in the matter of management, catering, amusements, &c., and is equipped with all the necessary appliances for cooking by gas, which are supplied and manufactured by the firm. A corner of the building is reserved for a co-operative store, which is also under the men's own management. There are many other clubs and institutions in which the employees are interested. In the mess-room, the visitors found high tea awaiting them.

The PRESIDENT afterwards said he was sure they would all like to have some remarks from Col. Glover.

Col. GLOVER said he would be very brief, as the tour of the works had taken a longer time than had been anticipated. This, however, he took as a compliment, because it showed the members were interested in what they had seen. The care and exactitude with which all the different processes were carried out should convince everybody that the gas-meter was an instrument of the greatest accuracy. When meters went wrong, it was not the instrument or the maker that was at fault, but the consumer, who had worn the meter out by putting too much gas through. The new standard lately announced had for its object to prevent meters being over-driven; but he was afraid it might not have this effect. If a gas-engine, steam-engine, motor, or boiler, was over-driven, no lasting wear would be got out of it; and it was exactly the same with a meter, which had to drive itself, and also had to register accurately. Meters, of course, were tested to pass a certain amount of gas per revolution; but he had known a ten-light meter to be used for a consumption of 250,000 c.ft. of gas in eleven months. This was pretty hard work. The amount of gas that was made to go through a meter was a very important point to his firm, because their meters were sent out with a five-years' guarantee. He begged everyone to remember that a gas-meter was not a race-horse, and was only tested to pass a specified quantity of gas. He hoped the members had enjoyed their visit, because the Company were proud of their works, and also of their staff. Since the war, they had been working together in a wonderful way for the good of the business; and in this respect they could show a lot of other works a good example. He would like the visitors to know that they were the guests of the Gothic Club, which was run entirely by the employees, and had nothing to do with the firm. Every effort was made by the Company to combine amusement with work; and he thought this had had, and would continue to have, a very good effect. He put in an earnest plea for co-operation all round, and mentioned that though they were 800 strong at the Gothic Works, they were as one man. There were no loggerheads. In conclusion, he welcomed the members heartily, and said it would be a pleasure to give what further information might be required to any who cared to visit the works again.

The PRESIDENT said the Association were very much indebted to the firm for the facilities afforded for the visit, and for their hospitality. The arrangements made for the inspection were excellent. There were plenty of examples throughout the works of exceedingly good organization, coupled with efficiency. For the success of the visit, they owed hearty thanks to a number of gentlemen; and in addition to those already mentioned, he named the following: Messrs. A. P. Main, jun., Merriman, Potter, Hoyle, Coggin, Whimster, Marley, Davis, M'Leod, Helps, Upton, Howlett, Shildrick, Defries, Crowl, Auckland, and M'Pherson.

Mr. J. HEWETT, in proposing a vote of thanks, said that one of the things which had struck him most was the good-fellowship that seemed to exist between the heads of the departments and the workpeople.

Mr. D. J. WINSLOW, who seconded, remarked that the name of the firm had long been a household word.

Mr. GLOVER CLARK, responding, declared that it had given them all the greatest pleasure to have the Association there; and their hope was that it would not be very long before they saw them again.

Mr. J. SPINKS (Foreman of the Tin Shop, and Chairman of the Club) also said a few words in acknowledgment.

Welded Roof-Truss Construction.

Roof-truss construction designed in accordance with the patent of Mr. W. D. Clay, of the Clay Boiler and Machine Company, Ranger, Texas, differs from heavy steel structures in that the framework is made-up of tubing in which the joints are formed by welding. As the completed frame is in reality one piece, the need for rivets, bolts, or screws is done away with. In this way, buildings of any required size can be erected without interior pillars. Superior strength is claimed on account of the use of tubing which, under certain kinds of stresses, is stronger than any other structural form of equal weight, as well as to the fact that the oxy-acetylene welded joint can be made even stronger than the sections of tubing joined—thus reinforcing the structural members, instead of reducing their strength. The smooth finish of the welded joints, it is said, also renders them less susceptible to rust and deterioration, thereby adding to the durability. Economy both in the matter of material and labour is claimed on the basis of the saving in tonnage on any required factor of strength, and because the welded joint can be made more cheaply than either the screwed joint or the riveted or bolted joint. At the present moment, the Company named are erecting a building on this principle for their own purposes, the dimensions of which will be 100 ft. by 200 ft. The sides and ends will be of concrete, 10 in. in thickness, finished in marble. The roof will be sheathed with reinforced concrete slabs 2 in. thick. There will be a skylight 28 ft. wide and two 2½ ft. ventilator shafts—skylight and shafts extending the entire length of the building. The floor will be of concrete; and there will be steel-sash windows and roller doors. A large chain hoist will be swung to one of the trusses for the loading and unloading of heavy weights. This will be the largest building of its type yet erected; but it is stated that it by no means indicates the limit of dimensions to which the new welded tubular construction may be advantageously adapted.

There is to be a meeting in the Royal Technical College Glasgow, on Saturday evening, Jan. 14, of the Western District Section of the Scottish Junior Gas Association, at which Mr. E. Nelson, of the Provan Chemical Works, Glasgow, will read a paper on "Works Practice on Bye-Products."

A lecture on "Internal Combustion Engines" is to be delivered by Mr. James Robson, of Messrs. Tangyes, Birmingham, to the Midland Junior Gas Association, at their meeting to-morrow (Thursday) evening. The lecture will be illustrated, and will deal with the history and design of gas-engines, particularly of the "two-stroke" type. As Mr. Robson was associated with his father in pioneer work on gas-engines, and has been connected with the development of this form of power throughout his life, the lecture will certainly prove both interesting and instructive.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Gas Pressure and the Gas Regulation Act.

SIR,—In the condensed report of Mr. W. J. Sandeman's paper on "Progress in Gas Lighting," which appeared in your issue of Dec. 21, you inadvertently omitted his very important reference to the pressure desirable for inverted gas-burners. Perhaps I may be permitted to give for the benefit of your readers the following extract:

> Although in incandescent lighting the candle power depends to some extent upon the calorific value of the gas, it is primarily affected by the pressure at which the gas is supplied. In the days of flat-flame burners, 5-10ths inch pressure (water column) was considered adequate; for incandescent burners pressures of 25-10ths to 30-10ths are needed, if a really "full" mantle is to be secured.

In the discussion on the paper, I referred to this official recognition by an eminent gas engineer of the need for a pressure at the burner actually greater than any of the demands put forward by the Railway Companies when the Gas Regulation Act was under discussion, and which you, Sir, have characterized as unreasonable. It now appears that they were by no means unreasonable—at least in the opinion of Mr. Sandeman, who ought to know.

Mr. Goodenough, in his remarks as Chairman of the meeting, tried to show that there was no inconsistency between Mr. Sandeman's recommended pressure and the position taken up by the gas industry regarding the Gas Regulation Act, on the ground that a penal minimum pressure was a very different thing from a general working pressure. But, with all due allowance for safe margin over the penal limit, a gas company need not, under the Act, work at more than (say) 25/10ths in the main at its worst point; and I should like to ask Mr. Goodenough how the consumer will get the 30/10ths at his burner which is said to be desirable, if he only has 25/10ths on the inlet side of the meter. I gather from Mr. Goodenough's further remarks that no hardship would have been experienced by the more progressive companies if the penal limit of pressure had been fixed at a considerably higher figure than 20/10ths; and clearly this would have been an advantage to the consumer, as Mr. Sandeman now shows.

Legislation has evidently studied the interests of small companies; and thus it appears that indifferent practice has been legalized and received a certain official recognition. While the small companies must doubtless be considered, it is much to be regretted that the more enlightened companies did not see to it that the best practice was legalized; special provision being made for those companies not at present in a position to fall into line.

Waterloo Station, S.E., Jan. 4, 1922. A. CUNNINGTON.

[A note on this letter appears in an early column of this issue.—ED. "G. J."]

Errors in Water-Flow Calorimeters.

SIR,—Prof. Cobb and Mr. J. W. Wood, in their reply to the discussion on "Recording Calorimeters," have criticized adversely my suggestion that the Thomsen type calorimeter should be used as a standard in connection with small gas-works, as a solution of the financial problem which standard calorimetry presents to them. In effect, Prof. Cobb and Mr. Wood state that:

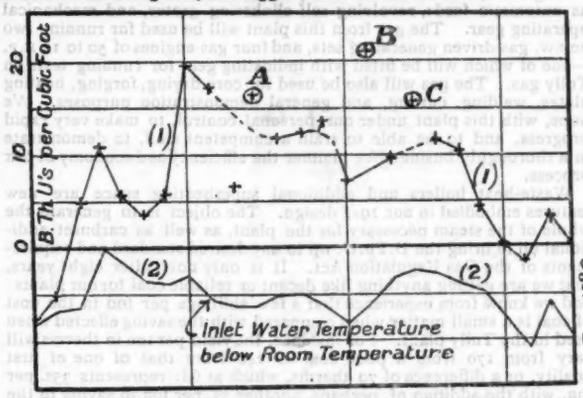
(1) There would be difficulty in obtaining a representative sample.
(2) The composition of the gas would be liable to change before determination of its calorific value.

I cannot believe that either of these factors would produce a serious error; and I should be glad to know what percentage error they would cause in practice. The matter is of some importance, because the only alternative is to thrust water-flow calorimeters on the (roughly) thousand small gas-works throughout the country, at a cost of (say) £50,000 without making any provision for thermostatic control of the water supply to these calorimeters.

Having installed these water-flow calorimeters, what accuracy would the small gas-works achieve in their use? Of available data we have the Research Committee's own figures, which show a radiation error of 1½ B.Th.U. per c.ft. for a variation of 1° Fahr. between the mean temperature of the calorimeter and its surroundings. In practice, a variation of 10° Fahr. is quite common, due to the variation between room temperature and water inlet temperature; so that a determination made at the lower temperature would give a result of some 20 B.Th.U. per c.ft. higher than one made at the higher temperature—a gain of 15 B.Th.U. due to diminished radiation, *plus* about 5 B.Th.U. due to additional heat taken from the products of combustion. Could the objections brought forward by Prof. Cobb and Mr. Wood produce any such startling error as this?

The Committee's results do not disclose an isolated case. In a recent comparison between a "Sigma" B.Th.U. Indicator and a Junkers Calorimeter extending over a week, it was the "Sigma" instrument that proved itself the more reliable—a variation of 20 B.Th.U. between the two instruments being largely accounted for by radiation errors in the Junkers, due to changes of its temperature relative to that of the room. In fig. 1, (1) the B.Th.U. difference between the two instruments and (2) the temperature of the inlet water below room temperature, are plotted, and show within the accuracy of the experiments the dependence of the former on the latter. Points A, B, C, which do not lie on the curve have an additional error caused by making a measurement before the water inlet temperature had become steady. They are early morning readings, taken before the water in the supply-tank had fallen to that of the incoming water.

Before anything useful can be done in the application of the water-flow calorimeter, its errors must be investigated and analyzed, so that one can estimate the errors under all ordinary conditions of working. Also we want to know whether any water-flow calorimeter is free from large radiation errors; for there is no point in advocating the use of the water-flow instrument as an element of a recorder until the radiation error is eliminated. The advocates of its use may suggest temperature control of the inlet water; but until better means are available for doing this, the suggestion is of no value.



In advocating the use of the Thomsen-type standard calorimeter—one of which could be made to serve any number of gas-works—I believe that I have the support of many gas managers, particularly of those connected with small works.

In conclusion, I would like to express the wish that the Research Committee may find it possible to investigate fully the question of accuracy of both water-flow and constant-water calorimeters.

Avon Works, Stratford-on-Avon, Jan. 3, 1922. J. G. STEWART.

Development and Perfection of the Tully Process.

SIR,—Let us forget the past year, with all its financial difficulties and trials, and look forward to a glorious New Year, 1922. It makes one feel young to be able to commence the year with the brightest of hopes, and with the greatest certainty of success. We have at last solved the greatest difficulty we had to contend with in the design and construction of the generator, with the result that any class of gas coal (even Durham) can be successfully used without any difficulty whatever; and even units of 2 million c.ft. per day can be operated by one man. We have recently obtained that which forms the mainstay to every business, a very strong financial backing—a fact which speaks for itself in these days of stringency.

It often happens in industrial chemical operations that, when trying to achieve certain chemical reactions, others of equal importance are obtained. It was just such an incident as this which happened when trying to make a gas rich in hydrogen from the Tully plant, by means of a second exothermic reaction—viz., $CO + H_2O = CO_2 + H_2$. We got, in addition, a third reaction—$CO_2 + C = 2CO$—and, instead of an increase of CO_2 as expected, we had a gas of the following analysis, and have since been able to repeat these reactions at will on several other plants:

	P.Ct.
CO_2 and H_2S	1·5
O_2	0·2
CO	39·4
C_nH_n / CH_4	10·7
H_2	48·2
N_2	0·6

This, of course, led up to investigations, and the solving of a very pretty and interesting problem indeed, which will have a great bearing on the whole future of the gas industry, and the industrial world generally.

With the old method of working on coal, it was not unusual to have as much as 9 p.ct. of CO_2, due to oxygen and moisture in the coal. Under the new process, we are able to replace the CO_2 by CO and H_2. Moreover, we are able at the same time to fix the tar and other hydrocarbons into permanent gases without serious degradation, resulting in complete gasification.

The following analysis of Tully gas—from a South Yorkshire steam coal—points to this fact:

	P.Ct.		P.Ct.	
CO_2 and H_2S	2·1	..	2·0	300,000 c.ft. per day plant
O_2	0·3	..	0·2	
CO	39·2	..	38·1	
C_nH_n	1·5	..	1·0	Make per ton average 50,000 c.ft.
CH_4	12·2	..	11·7	
H_2	41·0	..	43·8	422 and
N_2 by difference	3·7	..	3·2	Cal. V., 412 B.Th.U.
	100·0		100·0	

A good gas coal would certainly give even better results than these.

The following analysis shows another instance of the advantage of the new method of working, when using a mixture of 50 p.ct. cannel to 50 p ct. coke:

	P.Ct.	
CO_2 and H_2S	4·5	300,000 c ft. per day plant
O_2	0·5	
C_nH_{2n}	2·0	Sample taken from relief holder
CO	35·0	after standing three days.
H_2	45·99	Cal. V., 404 B.Th.U.
CH_4	9·28	
N and difference	2·73	Make per ton, 45,000 c.ft average.

These results were obtained without any special tuning-up; and no doubt with care a gas could be obtained containing only 2 to 3 p.ct. of inerts. This goes further to prove that degradation of the hydrocarbons is not taking place to any appreciable extent.

My Company are so satisfied with the results obtained that they are now putting down a complete experimental gas generating station

at our works at Newark, having a capacity of 300,000 c.ft. of gas per day, with holder, purifiers, and condensers, and fully equipped for testing coals, or for the trial of any modifications or alterations—such as automatic feeds, revolving self-clinkering grates, and mechanical operating gear. The gas from this plant will be used for running two 80 KW. gas-driven generating sets, and four gas-engines of 50 to 12 H.P. —one of which will be fitted with indicating gear for running tests on Tully gas. The gas will also be used for core drying, forging, heating plates, welding, cutting, and general demonstration purposes. We hope, with this plant under our personal control, to make very rapid progress, and to be able to train a competent staff, to demonstrate in a thoroughly businesslike manner the efficiency and economy of our process.

Waste-heat boilers and additional superheating space are new features embodied in our 1922 design. The object is to generate the whole of the steam necessary for the plant, as well as carburet additional oil to bring the B.Th.U. up to any desired standard and requirements of the Gas Regulation Act. It is only now, after eight years, that we are getting anything like decent or reliable coal for our plants; and we know from experience that a few shillings per ton in the cost of coal is a small matter when compared with the saving effected when used in the Tully plant. For instance, the yield per ton in therms will vary from 170 from a poor coal to 240 from that of one of first quality, or a difference of 70 therms, which at 6d. represents 35s. per ton, with the addition of, perhaps, another 5s. per ton in saving in the reduced cost of clinkering and loss of time. Where does the saving of a few shillings per ton come in? You cannot pass the coke on as in ordinary carbonizing processes, but have to use it yourself. In that case, have the best every time. Plants of our latest design will use any kind of coal—preferably a good gas coking coal, low in ash, and high in sperm value. The older design plants are best worked on a mixture of coke and coal, or preferably cannel. These plants, however, should be altered to the new method of working, which can be accomplished in a few hours, when cold. This alteration will certainly effect an increase of 40 to 50 B.Th.U. in the quality, and 15 to 20 p.ct. in the output, and will be willingly carried out by my Company at cost price.

Several large industrial orders are in hand, and contracts in the course of negotiation, amounting to many million cubic feet per day. These, and the foregoing facts, relieve us of any anxiety as to work for the next few years. The complete plant is now manufactured by us to standards, at our works at Newark; erected, marked for re-erection, or packed for shipment abroad, within one month or less on receipt of the order. The adverse conditions of war and strike time contrivances, coupled with resultant inferior labour, are, thankfully, things of the past.

The success achieved is, in a great measure, due to the co-operation and assistance rendered to us by the undertakings and engineers who have had sufficient confidence in us to place contracts for plant that was, more or less, in its experimental stage. The profits arising out of these contracts, running into many thousands of pounds, have been ungrudgingly spent on experimental work, and developing and perfecting the process. My Company look upon our clients as partners with us in this scheme, and, in return for their help, intend giving them the advantage (at cost) in any improvement they have, or propose adopting in the plant.

Out of 150 clients, we have had only—but for one exception—the most friendly support. The question of making large profits has never been the primary feature in the running of my Company, but rather to perfect our process at any cost. The soundness of this policy is proving itself by the repeat orders and new inquiries received from all parts of the world. We have no fear of competition, because, after all said and done, experience counts. Science, chemistry, and technology are all factors that can be easily hired; but practical experience is only gained by much expenditure and years of labour. A perusal of the register of patents often reminds me of my early efforts of over twenty years ago. Had I foreseen a fraction of the disappointments and trials of the past years, I would never have had the courage to tackle the business. The carbonization of coal at first acquaintance seems a very simple proposition; whereas in reality we know very little indeed about its composition and peculiarities. It is, however, with the belief that we have gained some knowledge of these peculiarities that we so cheerfully welcome the future.

C. B. TULLY.

Newark-on-Trent, Jan. 2, 1922.

University Grants.

SIR,—I enclose a copy of a letter which the sister Universities of Birmingham, Durham, Leeds, Liverpool, Manchester, and Sheffield have addressed to the Prime Minister, urging, on grounds of national importance, the danger of any reduction in the grants now made by the Government to the Universities and University Colleges of Great Britain. Since its dispatch to the Prime Minister, the Vice-Chancellors of the Universities of Oxford, Cambridge, London, Bristol, Wales, Glasgow, and Aberdeen have expressed their concurrence in it in a separate letter addressed to Mr. Lloyd George.

The Universities have received official information that it is proposed to reduce the grant (which, for the year 1921-22, was £1,500,000), by the sum of £300,000.

The reduction now announced will gravely embarrass the Universities in their work, especially in the development of advanced studies in science, medicine, literature, and technology. It will also inevitably restrict the work of the Universities in adult education.

I am desired to express the hope of the Universities concerned that you will be so good as to publish the enclosed printed memorandum in full or in part, and, if you think fit, support it by your influence.

MICHAEL E. SADLER,
Vice-Chancellor of the University of Leeds.

The University, Leeds, Jan. 9, 1921.

[ENCLOSURE.]

TO THE RIGHT HONOURABLE DAVID LLOYD GEORGE, M.P.

SIR,—On behalf of the sister Universities of Birmingham, Durham, Leeds, Liverpool, Manchester, and Sheffield, which provide opportunities of University education for 12,000 students, the great majority of whom live in the Midlands and North, we beg leave to submit to you the following considerations against any reduction being made in the amount of the grants paid by Government towards the cost of the work of Universities and University Colleges in Great Britain. In doing so, we desire to express our obligation to His Majesty's Government for the notable help given to the Universities towards their support during recent years.

2.—Recognizing the need for the utmost economy in public expenditure at the present time, our Universities have restricted their outlay within the narrowest limits consistent with their continued educational efficiency. To this end personal sacrifices are being made, and many developments, in themselves not only desirable but urgently needed, have been foregone. But we are persuaded that the grants now made to us by Government are at the lowest level at which the due discharge of our duties to the nation can be guaranteed, and that any retrenchment would be hurtful to public interests and wasteful of outlay already made.

3.—Shortly after the outbreak of war in 1914, the Committee on Public Retrenchment contemplated the suspension of all grants paid by Government to the Universities and University Colleges. A memorandum was forthwith submitted to that Committee on Aug. 26, 1915, by the Vice-Chancellors of the sister Universities of Manchester, Liverpool, Leeds, and Sheffield. The Committee on Public Retrenchment did not recommend the withdrawal of the University grants. In consequence, the Universities were enabled during the continuance of the war to render to the nation services previously unforeseen, and subsequently acknowledged by the Government as of vital importance. Mr. Austen Chamberlain, referring to this subject in Birmingham, said that "there was not an aspect of national life in which the acquired experience of the Universities did not render assistance without which it was difficult to say how we could have won the victory which eventually crowned our efforts." It is certain that, if the means are not withheld from them, the British Universities are in a position to render not less signal service to the nation during the coming years of peace.

4.—The Universities, now organized upon a popular basis, give opportunity to the young men and women of the rising generation from every type of home. The University in England and Wales has become (as it has long been in Scotland) representative of the whole people. The Universities are the recruiting and training grounds for the great professions and for the public services, local and central. The sacred ministry, medicine and dentistry, the teaching profession, the legal profession, as well as the administrative services, rely mainly upon the Universities for the maintenance of their high standards. The Universities train both workers and leaders for industry. They educate chemists, physicists, steel experts, civil, mechanical, and electrical engineers, architects, farmers, colliery managers, metallurgists, textile managers, gas engineers, dyers, and leather trade experts. The Universities advance science. They are the chief centres of research. Their work has helped to enrich British industry and commerce, and has added millions to the national wealth. The Universities extend the frontiers of knowledge in all other departments of study—in history, with its bearing on politics; in economics; in international law; in psychology which throws light upon movements of opinion; and in languages, the study of which meets many Imperial needs. The Universities, on whose behalf we write, are open on equal terms and in all respects to men and to women. Aid from public funds has alone made it possible for them to offer the opportunity of a University education at a fee which has kept them accessible to applicants of promise but of slender means. By means of student self-government and by the corporate life in residential halls, the Universities train men and women for the responsibilities of citizens, whether as leaders or in submission to the common will. In fact, the Universities hold the keys of the future, for they supply practical needs of the Empire which cannot be met from any other source.

5.—The funds which they now command are already inadequate for the needs of the British Universities.

(*a*) Almost all of the sister Universities have sustained a heavy loss on the working of the last academic year.

(*b*) All are short of what should be spent annually, even upon the least adequate scale, in order to attract a succession of the best recruits for the filling of vacancies in the teaching staffs. This deficiency is not less than £500,000 a year.

(*c*) All are short of the means of providing for advanced students in general, and for those from overseas in particular, opportunities of study and research. Failure to meet the requirements of overseas students will weaken the bonds of the Commonwealth.

6.—In order to meet their urgent needs, our Universities have made every effort of self-help, and in this have been loyally supported by the students and their parents, as well as by private benefactors, by large firms, and by the local authorities of the areas which we serve.

(*a*) We have practised severe economy in all structural expenditure and in the maintenance and equipment of laboratories.

(*b*) We have raised the fees for courses of study and for examination by considerable amounts. This can only be justified as an emergency measure. About a third of the total income of our Universities comes from students' fees.

(*c*) We have collected from private benefactors during the last three years £1,175,000 for the maintenance and, where necessary, the development of the Universities.

(*d*) The local authorities of our areas have supported us by increasing their annual grants from £74,268 to £135,868. (Detailed figures are given in the appendix.)

The Government urged us to make the efforts which have led to this measure of success by encouraging us to hope that what we raised locally would be met by a corresponding increase in Government Grants.

7.—In other countries, with which Britain must endeavour to hold her own, renewed efforts have been made since the war to strengthen the resources of Universities. The latter are held by the Governments and electorates concerned to be indispensable factors in the strength of the nation, and are reckoned among the chief sources of its

intellectual, administrative, and commercial power. In Germany, the Governments have shown that they attach the highest importance to Universities as centres of training for the professions, for responsible posts in industry and commerce, for scientific expert knowledge, and for the public services. They regard the Universities as homes of research for the advancement of knowledge and its application to national policy and to human welfare. Furthermore, they encourage and aid the Universities to provide wider opportunities of adult education for men and women who cannot reside at them for full-time courses of study. In the United States, the generous endowment of Universities puts Britain to the blush. Gifts to Universities, whether they are maintained from corporate funds or by the State, are a conspicuous feature of modern American life. It is there felt that, in whatever else economy must be practised, Universities should be generously maintained, and that expenditure upon them from public funds is not only one of the most profitable of investments, but an indispensable guarantee of national welfare. Gifts to Universities, up to 15 p.ct. of the donor's income, are by Federal Law exempt from Federal income-tax. The liberality of private benefactors is thus encouraged by a tempting concession from public funds. In Canada, not only the great incorporated Universities like McGill, but the State Universities, receive increasing subsidies from public funds and gifts from private benefactors. Canadians feel that they cannot afford to lag behind the United States in University development, and they would regard with concern any failure on the part of Britain to maintain her Universities in high and increasing efficiency.

8.—But retrenchment in the present grants would threaten the Universities with debility, and would check their growth as democratic institutions. Their work is part of the life insurance of the nation. To fail to keep-up the premiums would, we submit, be unwise. A refusal to spend upon Universities what University work requires would discredit Britain in the eyes of other peoples, not least in the eyes of the sister nations of the Commonwealth, and would disconcert and dishearten the most intelligent of our citizens, especially those of the younger generation.

We have the honour to be, Sir,
Your obedient Servants,
C. GRANT ROBERTSON,
Principal of Birmingham University.
DAVID DRUMMOND,
Vice-Chancellor of Durham University.
M. E. SADLER,
Vice-Chancellor of Leeds University.
J. G. ADAMI,
Vice-Chancellor of Liverpool University.
HENRY A. MIERS,
Vice-Chancellor of Manchester University.
W. H. HADOW,
Vice-Chancellor of Sheffield University.

Dec. 10, 1921.

APPENDIX.

GRANTS BY LOCAL EDUCATION AUTHORITIES TO THE UNDERMENTIONED UNIVERSITIES.

	1913-14. £		1921-22. £
Birmingham University	15,450	..	17,890
Durham University	5,501	..	16,346
Leeds University	16,022	..	28,776
Liverpool University	13,919	..	21,415
Manchester University	6,150	..	11,750
Sheffield University	17,226	..	39,691
	74,268		135,868

REGISTER OF PATENTS.

Vertical Retorts and Gas-Producers.—No. 148,943.

HENNEBUTTE, H. G., of Paris.

No. 20,777; July 10, 1920. Convention date, March 12, 1918.

This invention relates to vertical retorts and gas-producers in which the material travels by gravitation only through zones of gradually increasing temperature obtained by means of external circular heating chamber or chambers, and in which the distilled-off products are drawn-off by separate openings in successive heating zones through a plurality of gas collectors, each leading to a separate gas outlet.

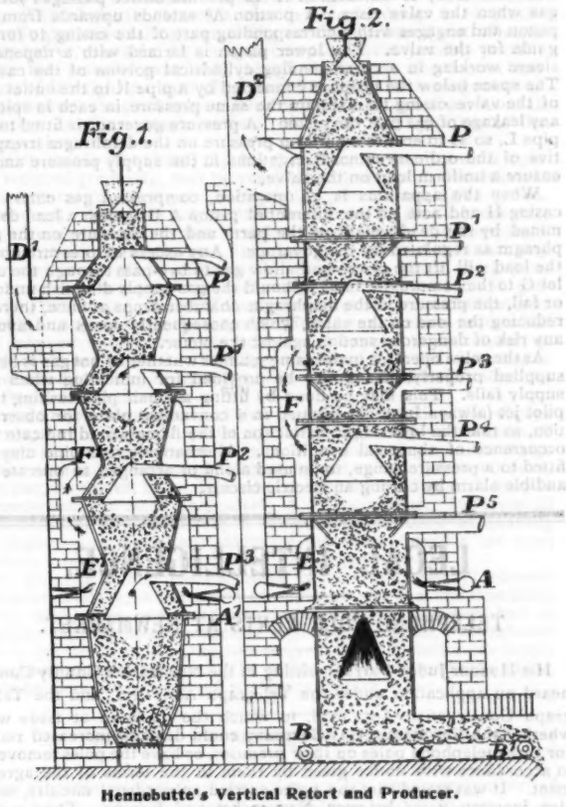
The materials to be distilled travel under the action of gravitation only through the retort, thereby rubbing the surfaces against the sides of the retort in the course of their descent, and parting in this manner with the outer layer of material the gases of which have been already extracted and presenting a surface of fresh material to the direct action of heat. A retort of this type is provided with a plurality of separate independent superposed collectors for the gaseous products of the distillation arranged to draw-off the products at each zone and opening centrally of the zone—the heat being derived from a plurality of external circular heating chambers. The retort is, moreover, provided with either a cooled chamber for the carbonized products or a combustion chamber.

In the illustration, the material is fed to the top of the retort and descends through successive zones of increasing temperature, while at each zone the distilled-off products are collected and drawn-off by means of a chamber arranged in communication with a condenser. To this end the collectors P, P^1, P^2 and so on (fig. 2) are arranged along the height of the retort through which the distilled-off products pass out as quickly as they are formed.

The firing at each zone takes place by means of circular chambers E E^1, communicating with each other as shown at F F^1. The firing may be augmented by the gas produced by the distillation, the circulation of which gas may be made methodically from the bottom upwards, so as to use the combustion heat of the material to be distilled.

From the last distilling zone, the carbonized products pass through a cooling chamber, whence they are removed by suitable means, such as an endless chain or the like.

Fig. 2.



Hennebutte's Vertical Retort and Producer.

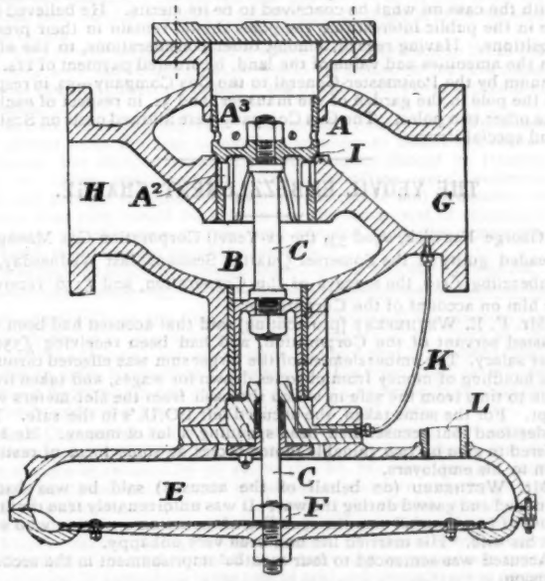
In the modified form of the invention shown in fig. 1, the cooling chamber illustrated in fig. 2 is replaced by a combustion chamber; and in this form the invention may be utilized as a gas-producer.

Gas-Compressing Plant.—No. 172,064.

GRIMKE-DRAYTON, N. D., of Westerham, Kent, and TOOTH, L. F., of Wanstead, E.

No. 22,619; July 30, 1920.

This invention relates to gas-compressing plant provided with a by-pass valve adapted to open automatically should the inlet pressure fall below a certain amount—more particularly to plant of the kind wherein gas passes through a meter to a compressor. It has for its object to prevent risk of damage to the meter by the supply of gas becoming restricted or cut-off while the compressor is running, and so resulting in the collapse of the meter.



Grimke-Drayton and Tooth's Gas-Compressing Plant.

The illustration shows a form of valve suitable for the purpose. The valve (of the differential type, to ensure a large flow of gas) consists of an upper piston A and lower piston B secured to a spindle C. Secured to the lower portion of the casing is a chamber E, within

which is mounted a diaphragm secured to the lower end of the spindle at F. The upper piston is formed with a coned portion I adapted to engage a corresponding seating formed with a depending sleeve cut away as indicated at A^2 to provide outlet passages for the gas when the valve rises. A portion A^3 extends upwards from the piston and engages with a corresponding part of the casing to form a guide for the valve. The lower piston is formed with a depending sleeve working in a corresponding cylindrical portion of the casing. The space below the piston is connected by a pipe K to the outlet side of the valve casing to maintain the same pressure in each in spite of any leakage of gas past the piston. A pressure governor is fitted to the pipe L, so as to ensure a uniform pressure on the diaphragm irrespective of the ordinary minor fluctuations in the supply pressure and so ensure a uniform load on the valve.

When the apparatus is in operation, compressed gas enters the casing H and acts on the differential piston A B against a load determined by the dead-weight of the parts and the pressure on the diaphragm as regulated by the governor. Any excess of pressure above the load will lift the piston and allow gas to bye-pass through the outlet G to the compressor inlet. Should the gas supply diminish unduly, or fail, the pressure in the diaphragm chamber drops at once, thereby reducing the load on the valve, which consequently opens and avoids any risk of dangerous suction against the meter.

As the valve operates in the same manner whether or not gas is being supplied properly, means may be provided for indicating when the supply fails. This may be done by fitting a small pipe leading to a pilot jet (always burning) situated in a convenient place for observation, so that the lowering or extinction of the flame would indicate the occurrence of abnormal conditions. Alternatively, the pipe may be fitted to a pressure gauge, to be used alone or arranged to operate an audible alarm by closing an electric circuit.

LEGAL INTELLIGENCE.

TELEPHONE POLE RENTS AT NEWMARKET.

His Honour Judge Farrant, sitting in the Newmarket County Court, heard an application under the Telegraph Act, 1878, and the Telegraph Construction Act, 1916, in which the question at issue was whether the Newmarket Gas Company could demand increased rents for three telephone poles on their premises, or have the poles removed, in accordance with notice given by them in the terms of the agreement. It was stated that the poles carried subscribers' circuits, and also junction wires between Newmarket and Exning. They were erected by the National Telephone Company in 1896, on consent given by the Gas Company, which provided for a payment of 1s. per annum, increased in 1901 to 1s. per pole. The telephones were taken over in 1912 by the Postmaster-General, who had continued the payment. In April of last year the Gas Company protested against the increase in telephone rates, declined to renew their agreement, and gave notice that the rent required for poles would be increased to 5s. each pole, failing agreement to pay which sum six months' notice was given to remove them. The poles were adjacent to the road, the first being inside the yard, the second in the corner of the manager's garden, and the third on a piece of waste ground further along the road and near a gasholder. In the original agreement, the Telephone Company undertook to remove the poles when given due notice. Mr. J. H. Troughton (Manager and Secretary to the Company) said there were at first very few wires on the three posts; but now there were a large number. It was not a fact that the whole business was only retaliation for the increased telephone charges. They had thought for a long time that 1s. was an inadequate rent. His Honour said he would deal with the case on what he conceived to be its merits. He believed it to be in the public interest that the poles should remain in their present positions. Having regard, among other considerations, to the effect on the amenities and value of the land, he ordered payment of 11s. per annum by the Postmaster-General to the Gas Company—5s. in respect of the pole in the garden of the manager, and 3s. in respect of each of the other two poles. The Gas Company were allowed costs on Scale B and special items.

THE YEOVIL EMBEZZLEMENT CHARGE.

George Fenwick, aged 33, the ex-Yeovil Corporation Gas Manager, pleaded guilty at the Somerset Quarter Sessions, last Wednesday, to embezzling £416, the moneys of the Corporation, and £156 received by him on account of the Corporation.*

Mr. F. E. WETHERLEY (prosecuting) said that accused had been the trusted servant of the Corporation, and had been receiving £350 a year salary. The embezzlement of the larger sum was effected through the handling of money from cheques drawn for wages, and taken from time to time from the safe in which the cash from the slot-meters was kept. For the sums taken, the accused left I.O.U.'s in the safe. He understood that accused had been spending a lot of money. He had offered to give up two valuable motor-cycles as some form of restitution to his employers.

Mr. WETHERED (on behalf of the accused) said he was badly wounded and gassed during the war. It was unfortunately true that the cause of his downfall was the spending of money on a woman who was not his wife. His married life had been very unhappy.

Accused was sentenced to four months' imprisonment in the second division.

The CHAIRMAN remarked that he had been treated leniently because there were extenuating circumstances, and there was no falsification of accounts.

* See "JOURNAL," Vol. CLVI., p. 634.

PARLIAMENTARY INTELLIGENCE.

PARLIAMENTARY BILL NOTICE.

Chester United Gas Company.

Notice was given in last Friday's "London Gazette" of the intention of the Chester United Gas Company to apply to Parliament in the ensuing session for an Act to enable them to substitute for the existing maximum price of gas and maximum rates of dividend a basic or other price and rates of dividend; to provide for varying prices in different parts of the Company's limits and in different cases; to permit the application of a share of profits to employees in connection with, or based upon, reduction in price to consumers; to increase the borrowing powers of the Company; to authorize profit-sharing or co-partnership; and to regulate the supply of gas and the administration of the Company.

MISCELLANEOUS NEWS.

GAS REGULATION ACT ORDERS.

There have been forwarded by the Director of Gas Administration copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

Eckington and Mosbrough Gas Company, Ltd.

As from the declared date, the maximum price in respect of gas supplied by the undertakers shall be 18d. per therm, and so in proportion for any less quantity supplied, provided that every fraction of one-half of a therm may be charged as one-half of a therm. (Dec. 29)

Gravesend and Milton Gas Light Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 19d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-one-fifth.

Prepayment meter clauses are included. (Dec. 30.)

GAS REGULATION ACT APPLICATION.

The following further notices have appeared in the "London Gazette" under the Gas Regulation Act.

SPECIAL ORDER.

Borough of Torquay (St. Mary Church Gas-Works).

Notice is given by the Borough of Torquay of their intention to make application to the Board of Trade for a Special Order under section 10, authorizing them to instal additional plant for the manufacture of carburetted hydrogen gas upon a specified piece of land in the parish of St. Mary Church, and to acquire further land for the purposes of their gas undertaking.

DECLARATIONS OF CALORIFIC POWER.

Abingdon Gas Light and Coke Company, Ltd.—450 B.Th.U. (Dec. 30.)

Chasetown Gas Company.—500 B.Th.U. (Jan. 2.)

Great Grimsby Gas Company.—450 B.Th.U. (Dec. 31.)

Huntingdon and Godmanchester Gas and Coke Company, Ltd.—480 B.Th.U. (Dec. 31.)

Swansea Gas Light Company.—450 B.Th.U. (Dec. 31.)

ORIGIN, OBJECT, AND APPLICATION OF THE THERM.

To good purpose—for he evidently succeeded in making his hearers clearly understand his subject—Mr. J. M. CAMPBELL (the Engineer and General Manager of the Isle of Thanet Gas Light and Coke Company) recently delivered an address to the members of the Margate Rotary Club on "The Therm: Its Origin, Object, and Application." Such explanatory addresses as this are of great use at the present juncture; and no doubt Mr. Campbell will find himself amply rewarded by the amount of good which will result to his Company from the clearing-up in this way of many misapprehensions that existed previously.

Though necessarily of a more or less elementary nature, the address went thoroughly into the matter. Mr. Campbell began by pointing out that the war has had the effect of changing almost everything, with the result that opinions which were only tentatively suggested prior thereto are now accepted as a matter of course, while subjects that in 1914 interested only the crank or specialist have now become of more or less general interest. Prior to 1914, coal was plentiful, cheap, and of good quality as a rule, with the result that it was wastefully used, and the study of economy or conservation was disregarded by both the general public and the authorities. During the war, however, when the price of coal was advancing rapidly, with its quality becoming worse and the quantity more scarce, the Government appointed a Committee (termed the Fuel Research Board) to investigate

the question, and to make suggestions as to the most economical methods of usage whereby this vital commodity might be conserved.

Gas undertakings, he went on, consume roughly 18 to 20 million tons of coal in a year; and it was inevitable that considerable attention should be paid by the Fuel Research Board to the most convenient and serviceable way by which coal might be employed in the operation of the manufacture of gas, in view of the large quantity involved. It was recognized by them, as it has been by many scientists and others, that the consumption of raw coal in an open grate conduces to the pollution of the atmosphere, besides imposing a distinct loss upon the community by the various valuable products passing up the chimney, which would be preserved by the coal being carbonized on the works of a gas undertaking. The Fuel Research Board realized at an early stage of their proceedings that gas undertakings might, under certain conditions, be able to effect additional economies in the use of coal by being permitted a greater amount of freedom in the quality and composition of the gas to be supplied.

Whereas in former times gas was employed almost entirely for the purpose of illumination, the calorific value is now the essential factor. In spite, however, of this, all gas undertakings have been until within quite recent years obliged to conform to a standard of illuminating power which was becoming year by year more antiquated and useless by reason of the greater extent to which gas was being used for its heating value; and to this the Fuel Research Board devoted much consideration in their inquiry.

His own Company, said Mr. Campbell, in 1914 succeeded in securing the change from the obsolete illuminating power standard to that of calorific value. The standard fixed in their case appeared likely to be adopted by Parliament as the universal figure; but the Fuel Research Board recognized that a uniform heating standard throughout the whole industry would, on account of the variations in manufacturing conditions, differing character and costs of coals, local conditions, and many other matters incidental to gas manufacture, create a more or less dissatisfied industry, and would not make for either economy or progress. Gas is not made exclusively from coal, as coke and oil are employed in a large proportion of works for the manufacture of carburetted water gas; while the local conditions applying to a gas undertaking must also have an important bearing on the question of the character and composition of the gas to be supplied. Hence the unwisdom of establishing throughout the industry a uniform heating standard. The Fuel Research Board, recognizing this, recommended in their report that each undertaking should be at liberty to supply the quality of gas best suited to its particular circumstances. Having reached this conclusion, it was felt that, in order effectively to protect the consumer, some alteration should be made in the method of charging for the gas consumed, and this involved the introduction by the Fuel Research Board of what is now known as the "therm."

Proceeding to explain the change-over from cubic feet to the therm basis of charging, the author pointed out that this new system has been made compulsory on all gas suppliers by the Gas Regulation Act. It has not been introduced by (say) the local company, merely as a subterfuge to exact further sums from the pockets of the already harassed consumer, as has been suggested in one or two cases elsewhere. The Act provides that, if any gas undertaking has not applied to the Board of Trade within two years after the passing of the Act, the Board of Trade may themselves make an Order, applying it to the undertaking after giving not less than three months' notice. It will thus be seen that it is absolutely compulsory on the part of gas undertakings to adopt the provisions of the Act by making application in the prescribed way, or waiting for the Board of Trade to apply it to them within two years after the passing of the Act. No suspicion must therefore attach to any gas undertaking for coming within the scope of the Act, which has for its main object the protection of public interests, and to secure that the gas consumer gets what he pays for by the establishment of a permanent quality at the cheapest possible rate.

Referring to the declaration of heat value which each undertaking is obliged publicly to announce, Mr. Campbell explained that this must mainly depend on the character of the coal which can be most economically purchased, together with the results to be secured by its carbonization with the manufacturing plant locally installed for the purpose. The Fuel Research Board conclusively elicited the important fact from their witnesses that, to secure the best results in consuming gas, it was not only unnecessary, but in many cases uneconomical, to employ gas of a high heating value, and that better, or as good, results were secured to the consumer by gas of a lower calorific value than that which was prior to the war generally accepted as being necessary. It was demonstrated more clearly by the Government Departments when, owing to certain strikes and other disturbances, they were obliged to issue orders for the supply of gas of not more than 450 B.Th.U. per c.ft., without any real difference being apparent to the consumer. The gas consumer will, for the same money, receive more gas of a lower quality than he will if the quality be higher; and consequently comparisons can be made with perfect accuracy as to the prices ruling with one undertaking and another. No proper comparison could be made between the prices charged by two adjoining companies under the old basis of charge, in view of the variation in quality that might be supplied by the respective undertakings. It is, Mr. Campbell continued, his Company's intention to declare 460 B.Th.U. as the quality to be supplied locally.

After referring briefly to the question of testing, he went on to deal with the provision in the Act that additions shall be made to the standard price of gas to cover unavoidable costs caused by the war—citing his own Company's case as a typical example. In their case, it is decreed that, with the price of gas at 4s. 2d. per 1000 c.ft., which represents the standard, the rate of dividend shall be 3½ p.ct.; and for every 1d. alteration, the dividend shall slide only 2s. 6d. p.ct. The relative amounts of 1d. per 1000 c.ft. reduction to the consumer securing the additional 2s. 6d. p.ct. to the stockholder are, of course, in our case most disproportionate, by reason of the fact that the former would mean roughly £1500 per year saving to the consumers, as against about £160 for the general body of stockholders. For some years before the outbreak of war, the Company's price for gas was 2s. 4d. per 1000 c.ft., representing a reduction from the standard price of 1s. 10d., and entitling the stockholders to 22 half-crowns additional dividend on the standard basis of 3½ p.ct. This 6¼ p.ct. dividend constituted the maximum distribution; and no further increase in dividend could be made unless the price of gas were further reduced. Similarly, by every increase in the price of gas the dividend became lower. This obviously created a considerable hardship to all stockholders in gas undertakings, as, owing to the increased cost of coal, labour, stores, renewals, &c., no gas company could possibly prevent rises in the price of gas; and, though these were not due to any absence of foresight or want of care on the part of the management or administration, the stockholders were obliged to accept diminutions in the return on their invested capital, owing to the operation of the sliding-scale.

The dividends distributed by his Company from 1914 until 1920 were reduced gradually, year by year, from 6¼ to 3 p.ct. (less income-tax in each case). Last year, owing to the price advancing to 5s. 6d. per 1000 c.ft., they were only entitled to pay 1½ p ct. (less income-tax), though by application to the Board of Trade under the Temporary Increase of Charges Act, 1918, they had been successful in securing an increase in this distribution to the magnificent figure of 2⅝ p.ct. (less income-tax). Parliament recognized this unfairness to the gas-investing public, and provided for such increases of the standard price to be made as appear to the Board of Trade to be reasonably required to meet any advances due to circumstances beyond their control, or which could not reasonably have been avoided; and this claim has to be embodied in the application made by each undertaking under the Gas Regulation Act.

In conclusion, the author said that periods of transition are always difficult; and this fresh system will for a time appear "uncanny," owing to the unfamiliarity of therms. But when the gas undertakings and the consumers become quite accustomed to the new conditions, there can, he thinks, be no doubt that the results will be satisfactory to all concerned, and more particularly to the consumer. In future all consumers will buy "heat," by a scientific combination of quantity and quality, with the definite assurance that their interests are most carefully safeguarded under the Gas Regulation Act.

Mr. WALTER HILLS (the Chairman of the Gas Company) followed with some remarks, in the course of which he said that the Company, during its history, now bordering on a century, had never had an Engineer and Manager comparable with Mr. Campbell. He referred also to the desire of the Directors to give the consumers a gas supply at the cheapest possible rate. The position of the consumer, he added, would be very much improved in the near future.

FINANCES AT STOCKTON-ON-TEES.

The Stockton-on-Tees Gas Committee's policy was severely criticized at the Corporation meeting on Tuesday of last week. Slot-meter gas consumers protested that they were now paying at the rate of 5s. 7½d. per 1000 c.ft., while other consumers were only charged 4s. 11d. The Committee had decided to allow a discount of 5 p.ct. to slot-meter users.

The ENGINEER (Mr. W. W. Atley) presented a financial statement in regard to the installation of horizontal retorts at the works. He said the loan for which sanction had been obtained for this work was £51,295, and a further sum of £14,115 was required to complete it. Because the work had cost more than anticipated and the loan was exceeded, the Committee recommended that, instead of an application for a further loan, a suspense account should be opened to which this expenditure should be placed, and that such an account be credited over the next five years with a significant sum to discharge the whole amount within that period, if the accounts from time to time should permit.

Mr. ALLISON wanted to know how far the excess of expenditure over estimate was justified. He moved that application should be made for a further loan, so that a public inquiry might be made into the reasons for the excess.

Mr. DUNN, who seconded, said it was a new experience so far as the gas-works were concerned; but it would be better to make a clean breast of the thing than try to pay it out of the profits over a period of five years.

Alderman NATTRASS suggested that as Mr. Allison and Mr. Dunn were absent from the Gas Committee meeting at which the recommendation was decided upon, the whole matter should be referred back for fuller consideration. The Committee were evidently optimistic enough to think the trade would revive and conditions so improve that they would be able to pay the money out of revenue in five years. If the other course were adopted, and the money was borrowed, it did not get rid of the liability.

It was decided that the question should go back to the Committee.

Hornsey's Cheap Gas Supply.—The consumers of the Hornsey Gas Company are to be congratulated—as is also Mr. J. W. Buckley, the Engineer and General Manager—upon the fact that it has been found possible to make a reduction in the price of gas from 11½d. to 11d. per therm—a figure which can only be regarded as exceedingly favourable, especially under the prevailing conditions of high costs.

Gas Charges at Neath.—The Neath Town Council have adopted a recommendation of the Gas Manager (Mr. W. C. Jackson) that the price of coke be reduced by 3s. 4d. to 3os. 8d. per ton; but Mr. Jackson said he considered it would be unwise to interfere with the price of gas during the present quarter. If, however, the thermal system could be introduced, he was of opinion that a reduction could be effected by the next quarter. Regret was expressed by several members that the Gas Committee did not see fit to recommend an immediate reduction in price, in view of the lower cost of coal and the decrease in wages; but the Chairman said the difficulty was the deficiency on the undertaking, which was a serious matter. One member stated that, owing to the high cost of gas, most of the working classes were reverting to the use of oil-lamps. It was understood that the Committee would reduce the charges in April.

TAXING IMPORTED ILLUMINATING GLASSWARE.

Applications Under the Safeguarding of Industries Act.

The Committee which has been appointed under Part II. of the Safeguarding of Industries Act to inquire into complaints as to the dumping of illuminating and other glassware, heard evidence on the question of illuminating glassware on Wednesday last. The National Gas Council in opposition to the demand for a tax are co-operating with the China and Glass Section of the London Chamber of Commerce; and the whole of this opposition was represented before the Committee by Sir ARTHUR COLEFAX, K.C., and Mr. EVANS, M.P. The procedure before the Committee is that counsel may appear and address the Committee, but must not cross-examine witnesses or put questions even to his own witnesses. Thus the witnesses have been examined by the Committee on proofs of evidence which have previously been supplied.

Mr. *James Bateman* (of Messrs. M. Bateman and Co., glass merchants and importers) dealt specially with illuminating glassware. Before the war there were three well known lines—viz., "Jena," "Resisto," and "Monopel." These were of the highest quality, though there was a lot of inferior glass on the market for which there was no great demand among the better-class houses. Messrs. Chance Bros. in their evidence had said that they had a monopoly of the business of the South Metropolitan Gas Company, and also of the James Keith and Blackman Company and Messrs. William Sugg & Co., Ltd.; and it was incidentally mentioned that the firm were receiving a price of 50 p.ct. more than that of imported illuminating glassware. The Committee had also been informed that the South Metropolitan Gas Company were the firm's best customer, and also that, owing to foreign competition, their sales had dropped. As a matter of fact, continued Mr. Bateman, since the war the "Monopel" and "Resisto" people had not manufactured a single article, and the "Jena" people very little. The "Resisto" makers certainly had some stock, manufactured before the war, which might have been sent to this country; but Messrs. Chance Bros. appeared to have secured practically all the trade that was available in these lines. With further reference to heat-resisting glassware, he understood that the Oesterreichisch-Glashuetten Gesellschaft, who were the manufacturers of the "Monopel" brand, had increased their price by 100 p.ct.; but they had been able to dispose of very little of this glassware. Messrs. Chance Bros. had also suggested to the Committee that heat-resisting glass was coming into this country from Japan, France, and Sweden. But Japan and Sweden did not manufacture heat-resisting glass, and France made it in very small quantities, and not of very high quality. Their prices were governed commercially; and they were only able to supply here at times, owing to the difficulty of obtaining supplies here during the war and shortly afterwards. His firm had been the agents for "Monopel" glassware. There had been an extraordinary falling-off in the requirements for this heat-resisting glassware; and as Messrs. Chance Bros. claimed to have secured 90 p.ct. of the business here, it appeared that they now wished to have a tax imposed, so that they could get the remaining 10 p.ct. and so secure a monopoly. During the three or four years immediately preceding the war the demand for heat-resisting cylinders and globes for electric arc lamps rapidly declined, consequent on the strides made with high-pressure gas lighting, and the development of the half-watt lamp. The arc lamp system of lighting was now practically dead; and high-pressure gas lighting reached its zenith just prior to the war. During the war, owing to the restrictions upon lighting and the difficulty of obtaining supplies of heat-resisting glassware, many lamps were put out of use; and when the restrictions were removed, it was only possible to obtain sufficient supplies of glassware to enable existing installations to be restored. This having been done, orders became scarcer, and, owing to the slump in trade, there was now very little business being done. In fact, one of his pre-war customers had told him that the demand in quantity had dropped in 1921 by 75 p.ct. compared with 1920—*i.e.*, taking 1920 as 100, the demand in 1921 was only 25. During the same period the drop in value was represented by 100 and 60 respectively. This appeared to prove conclusively that Messrs. Chance Bros.' difficulties were not due to imports, but to the general slump in trade. He agreed that the South Metropolitan Gas Company were the largest customer in the trade for this type of glassware.

The CHAIRMAN: You tell us Messrs. Chance Bros. appear to have secured all the trade that is available in this line; and therefore I suppose that means that your trade in this particular branch has come to an end?

Witness: Absolutely.

And the situation, so far as your business is concerned, is that all that the South Metropolitan Company and Messrs. Keith purchased from you before the war they now buy from Messrs. Chance Bros.?—Yes, they said so in their evidence.

And your contention is that the troubles of which Messrs. Chance Bros. complain are not due to imports but to the general decline in the demand in the lighting trade?—Yes.

Answering Sir THOMAS ALLEN as to the reason why Messrs. Chance Bros. obtained a price 50 p.ct. higher than that of imported glass, witness said he could only assume that it was done by the South Metropolitan Gas Company to encourage British industry. The quality of the goods which he had previously supplied to the Company had never been complained of. His point was that, having secured 90 p.ct. of the business here, Messrs. Chance Bros. had quite a sufficient share without asking for further protection—indeed, he regarded 90 p.ct. as more than sufficient.

In reply to Sir JOHN BARRAN, witness remarked that he did not handle electric globes. He had, however, recently been in communication with someone in the trade, and had been told that although the works at Leamington could supply all the demands in this country, they had recently had to discharge 120 men because of lack of orders. No incandescent electric lamp bulbs were being imported into this country; but the finished lamps were. This business, however, might now be stopped by the recent Court of Appeal order.

Replying to further questions, witness pointed out that Belgium did not make heat-resisting glass; most of it came from Austria. At present, the English makers were supplying his old customers direct. He had tried to get the agency for Messrs. Chance Bros.; but they had done the business themselves direct.

Mr. *S. S. Ogilvie*, Joint Manager of the National Gas Council, said the Council were acting in co-operation with the London Chamber of Commerce in this matter. On Jan. 11, 1921, when considering this whole question, the Council had passed a resolution that: "The free import of such articles as gas-mantles and heat-resisting glass is essential to the industry." The Council was strongly opposed to any duty being placed upon glassware used in the industry. This glassware consisted of heat-resisting glass and semi heat-resisting glass. Heat-resisting glass was used for high-pressure globes, ordinary chimneys, mantle protectors, and for shop lamps. Semi heat-resisting glass was found in the ordinary gas-globes, and was often etched and coloured. So far as heat-resisting glassware was concerned, it was estimated that the gas companies used and sold about £80,000 worth per annum; but this did not include the glass sold in connection with gas in the small shops and by ironmongers, which would probably amount to about another £40,000 per annum. In this connection, he pointed out that the local authorities who owned gas-works were also the public lighting authorities, and this accounted for their large use. The value of the semi heat-resisting glassware sold and used by the gas undertakings was about £25,000 per annum, also apart from that sold by the shops. The price of glassware had increased by about 150 p.ct. over the pre-war figure; but it was impossible for the British makers to supply a fraction of the total demands of the industry. Moreover, it was generally recognized that the quality of British heat-resisting glassware, with a few exceptions, did not compare with that coming from abroad. If a higher price was charged for illuminating glassware, which was already too costly, there was no doubt that fewer burners would be furnished with the glass. Where possible, they would be used naked. There would also be a tendency for the number of lights to be reduced, and so diminish the quantity of gas used. Indirectly, therefore, there would be a falling-off in the output of gas and in the maintenance of burners, which must tend to the employment of fewer men in the gas industry. He had noticed that Mr. Bassett, for Messrs. Chance Bros., had said that he was much impressed with the loyalty of the gas companies to the new British glass industry. He himself did not know how many gas companies still purchased from British glass manufacturers, and, of course, the National Gas Council did not desire to interfere in any way with the placing of their orders. At the same time, it must not be inferred from Mr. Bassett's evidence that the gas industry was in favour of a duty being placed upon foreign glassware for the purpose of assisting British industry. Further, Mr. Bassett, in the course of his evidence, had said—so he read in the "GAS JOURNAL"—that gas lighting was a declining industry, and that this accounted for the falling-off in the demand for this type of glassware. As a matter of fact, the chief factor with regard to the declining use of glassware for gas lighting was the excessive price; and a consumer would rather extinguish a burner or two than buy high-priced glassware.

At the request of the CHAIRMAN, witness explained the operations of the National Gas Council in some detail. The only large gas companies outside the Council were the South Metropolitan, the South Suburban, and the Brighton and Hove Companies, and the largest local authority was Oldbury. The Council were now recognized by the Government as the body representing both the technical and the commercial interests of the industry.

The CHAIRMAN: Are there represented on the Executive such large towns as Liverpool, Manchester, and Birmingham?

Witness said that was so.

The CHAIRMAN remarked that, considering how divided opinions were upon a matter of this kind among the great corporations, the Committee would like to be quite sure that the representatives of the great corporations on the National Gas Council were properly empowered to act on their behalf when the Council passed such a resolution as that which had been referred to. The resolution was as far back as January, 1921—before this Committee was formed.

Witness said he could produce a certified copy of the resolution or the minute book.

The CHAIRMAN expressed a wish to have a certified copy, and asked if the question of heat-resisting glass had been discussed since the resolution was passed.

Witness said the subject had been dealt with in connection with gas-mantles; and the principle laid down in the resolution had been upheld. The evidence of the Council had been accepted by the Referee under Part I. of the Act in relation to gas-mantles.

Speaking with regard to the statement that Messrs. Chance Bros. had secured 90 p.ct. of the trade in heat-resisting glass, witness said he could not understand this, and cast doubt upon it. He was satisfied that Messrs. Chance Bros. might sell 90 p.ct. of the heat-resisting glass manufactured in this country; but he did not think they were supplying 90 p.ct. of the total demands in the country.

Mr. *Bassett*, representing Messrs. Chance Bros., was recalled by the CHAIRMAN to explain the point. He said he had divided the glass into three sections—viz., large-size globes, medium-size globes, and small globes and cylinders. The evidence had been that his firm were getting 90 p.ct. of the trade in large globes which were used for outside lighting in the streets of London. This was a very small percentage of the whole of the heat-resisting glass trade in this country. The part of the trade in which there was very severe competition from Germany and Czecho-Slovakia was in the smaller sizes. They were getting a small percentage of the trade in medium-size glass. As a matter of fact, they were doing no business at all in the smaller sizes, owing to foreign competition.

Mr. *Ogilvie* was then further questioned by the members of the Committee. Asked as to where the members of his organization obtained their glassware, he said that some came from Jena; but he could not give full information at once.

Sir THOMAS ALLEN put it that the £145,000 worth of glass referred to in witness's evidence as the total required by the gas industry was a small figure to suggest that the British manufacturers could not supply.

Witness said that was a very low estimate which he had put in so that he should not over-state the case. The quantity sold by shops and ironmongers was very large—much more than that purchased by the gas authorities themselves for street lighting and other purposes.

Sir THOMAS ALLEN: In the absence of these figures, how do you come to the conclusion that British makers cannot supply the demand?

Witness pointed out that the figure was an estimate, and a low one. It all depended on the number of furnaces the makers had. Messrs. Chance Bros. were the only British firm making a quality of glass which was of value to the gas industry.

You say that there is only one firm here whose glass is of a quality comparable to the foreign, and it is not possible for them to turn out a fraction of what is required in this country?—That is so.

Mr. AITON put a number of questions directed to the point that if there is unemployment in this country among glass workers, it must lead to less gas consumption. Would not the effect of this be even worse than the reduced consumption of gas, as suggested, through less use of glassware owing to the high price of the latter.

Witness admitted that there would necessarily be a reduced consumption of gas on the part of glass workers who were unemployed, but only to a certain extent. It was only possible to argue on general grounds in dealing with this new situation which had arisen. The point he wished to make was that there would be serious unemployment in the gas industry consequent on the less sales, because people used less gas owing to the high price of glassware through a tax being imposed. He did not agree that the less sales of gas due to glass workers being unemployed would be more serious than the reduced consumption, because the general population could not afford to pay high prices for glass in connection with the use of gas.

Sir JOHN BARRAN took up the question of the manner in which the National Gas Council had discussed this matter, and the extent to which they could pledge their members to any resolution.

In reply to a long series of questions, witness explained that, owing to an oversight, the question of heat-resisting glass was not put on the *agenda* for the meeting of the Council on Dec. 13—the day after the Committee first met. On Dec. 23, however, he sent out a circular letter referring to the matter, and asking whether the individual Councils would agree to the National Gas Council working in co-operation with the London Chamber of Commerce. To this letter he had received a large number of favourable replies, and only two against. There was one neutral reply. Since then, he had sent out a further letter, saying that, in the absence of any communication to the contrary, he should assume that the corporation or company in question were agreeable to the adoption of the course suggested. He proposed sending all the replies to the Committee.

Sir JOHN BARRAN emphasized the point that this action had been taken several weeks after the Committee held their first sitting, and that there had therefore been very little time for the various companies and corporations to give the matter adequate consideration.

Witness replied that the whole question had been before the members since the January resolution. They had also been kept in touch with what had been going on through the medium of the Council's monthly "Bulletin:" and he felt he was entitled to draw the inference that those who did not reply to his circular letter of Dec. 23 were in favour of what was being done. Colchester and York were the two corporations who did not agree.

Sir JOHN BARRAN again put it that there had not been time for the various bodies to consider the matter and formally signify their views.

Witness contended that there had been ample opportunity for them to know the views of the Central Executive Committee, following the January resolution; but if the Committee desired it, he would bring the matter before the Executive Committee again at their next meeting. The position at the moment was as he had stated, and he would welcome any suggestion from the Committee as to what they thought ought to be done.

Sir JOHN BARRAN explained that he was anxious to get at the grounds of the support upon which the National Gas Council were proceeding. He did not make any suggestion that the proper steps had not been taken, but was anxious to make sure that the Executive Council really did, in this matter, represent the views of members.

The CHAIRMAN then took the matter up, and said that one of the peculiar difficulties of the situation was that 600 of the members of the National Gas Council were companies. He took it that the representation on the Executive Council was in the same proportion.

Witness: That is not so. The representation on the Executive is about half and half.

The CHAIRMAN remarked that while he could understand that it was quite natural for the representative of a company to commit his company in a matter of policy, it was different in the case of the representative of a corporation to do so on a question of general policy such as this, and therefore there should be specific replies on the question in regard to the circular letter of Dec. 23 in each case.

Witness agreed with that in law; but in fact he had no doubt that the members of the Executive Council did really represent the views of their corporations or companies as the case might be.

The CHAIRMAN: You wish us to understand that the great city councils are speedily made cognizant of the action of their representatives in these matters?

Witness: I have no doubt about it.

In reply to Mr. AITON, witness admitted that it was quite his own fault that the National Gas Council did not discuss this matter specially on Dec. 13; and they could blame him for this if they wished. If the Committee now thought there was any doubt about the question, he submitted that they should say he must place the matter before his Executive Committee.

Mr. AITON remarked that the thing that occurred to him was that if this was such a very important matter, and the National Gas Council was such a very important association, it would have been discussed quite early. The appointment of the Committee was noted in the public Press; and it was a matter which he should have thought could not escape being discussed by the Executive Council.

Witness pointed out that it would have been discussed if he had put it on the *agenda* for the December meeting. With all respect, he suggested that these questions were not relevant, because the matter had been discussed and the January resolution passed. If nothing at all had been done, these questions would have been relevant. In any case, he could not say anything fairer than that he would bring the matter before the next meeting of the Council.

The CHAIRMAN, in bringing the cross-examination to a close, said to witness: You will put in the documents we have referred to. The Committee will not have ended its proceedings by the date of the next meeting of your Council; and it is open to the body you represent to take what action it pleases, and it is open to you to put in any further resolutions you desire, and the Committee will then consider them.

The evidence for the opposition will be continued on Tuesday next Jan. 10.

LEEDS UNIVERSITY LECTURES.

Department of Coal Gas and Fuel Industries with Metallurgy.

In connection with the work of the Department, arrangements have been made for the delivery, during the second term of the session 1921-22, of the following special courses of evening lectures.

I.—THE MANUFACTURE OF COAL GAS.

Dr. H. G. COLMAN.

A course of twelve lectures will be given by Dr. H. G. Colman, D.Sc., Ph.D., F.I.C., of London, on Fridays at 6 p.m. and 7.15 p.m., commencing Jan. 20, and concluding Feb. 24.

SYLLABUS.

A general description of the plant and processes involved in the manufacture of coal gas and carburetted water gas. Horizontal, inclined, and vertical retorts. Construction of retort-settings. Methods of maintaining uniform temperatures throughout the retorts, with simultaneous economy in fuel consumption. The initial treatment of volatile products evolved from the retorts. Hydraulic and dry mains. Condensation. Elimination of tar fog and naphthalene. Exhausters. Wet and dry purification. Cyanide recovery. Other bye-products—*e.g.*, coke, tar, benzene, toluene, ammoniacal liquor, &c. Manufacture of ammonium sulphate. Spent oxide. Spent lime, &c. The manufacturing and carburetting of water gas. The analytical control of gas manufacturing processes. Discussion of recent advances in, and new requirements for, public gas supply.

Fee for the course, £1 1s.

Ia.—RECORDING GAS CALORIMETERS.

Mr. J. W. WOOD.

Two lectures will be given by Mr. J. W. Wood, M.Sc., A.I.C., Research Chemist to the Gas Research Committee of the Institution of Gas Engineers and the University, at 6 p.m. and 7.15 p.m. on Friday, March 10.

SYLLABUS.

The lectures will deal with the principles applied in the construction of recording gas calorimeters (Beasley, Simmance, Thomas, and Fairweather instruments), the sources of error and methods of use.

Fee for the two lectures, 5s.

II.—REFRACTORY MATERIALS.

Prof. J. W. COBB.

A course of eight lectures will be given by Prof. J. W. Cobb, C.B.E., B.Sc., F.I.C., of the Leeds University, on Tuesdays, at 6 p.m. and 7.30 p.m., commencing Jan. 17 and concluding Feb. 7.

SYLLABUS.

Physical and chemical principles on which the manufacture and use of refractory materials are based. Consideration of raw materials available and manufacturing processes. Choice of refractory materials for use in furnaces of different types. Methods of testing.

Fee for the course, 10s. 6d.

III.—METALLURGY.

Mr. P. F. SUMMERS.

A course of six lectures on the microscopic study of engineering alloys, followed by practical work in the laboratory, will be given by Mr. P. F. Summers, A.R.S.M., on Wednesdays, at 6 p.m., commencing Jan. 18 and concluding Feb. 22. The course will be divided into two parts, which may be taken separately.

PART 1. GENERAL (three lectures, with laboratory work).

An introduction to the metallographic study of engineering alloys, their preparation and examination.

PART 2. SPECIAL (three lectures, with laboratory work).

The microstructure and heat treatment of bronzes.

Fee for each part (including laboratory work) 7s. 6d., *together with a deposit (returnable) of* 10s. *to cover breakages.*

IV.—EVENING LABORATORY COURSE.

Prof. COBB, Mr. HODSMAN, and Mr. SUMMERS.

The laboratory of the Department will be open on Wednesday evenings between 6 p.m. and 9 p.m., from Jan. 18 to Feb. 22, for a limited number of students who have already received some chemical training, but who desire instruction in Fuel Calorimetry and Pyrometry. More advanced students, capable of independent work, may also be admitted to the laboratory during these periods.

Fee, 10s. 6d., *together with a deposit (returnable) of* 10s. *to cover breakages. The earliest possible application from intending students is requested.*

V.—DAY LECTURE CLASSES.

For information respecting the day lecture courses in the Coal Gas and Fuel Industries Department of the University—namely, pro-

which is mounted a diaphragm secured to the lower end of the spindle at F. The upper piston is formed with a coned portion I adapted to engage a corresponding seating formed with a depending sleeve cut away as indicated at A^3 to provide outlet passages for the gas when the valve rises. A portion A^2 extends upwards from the piston and engages with a corresponding part of the casing to form a guide for the valve. The lower piston is formed with a depending sleeve working in a corresponding cylindrical portion of the casing. The space below the piston is connected by a pipe K to the outlet side of the valve casing to maintain the same pressure in each in spite of any leakage of gas past the piston. A pressure governor is fitted to the pipe L, so as to ensure a uniform pressure on the diaphragm irrespective of the ordinary minor fluctuations in the supply pressure and so ensure a uniform load on the valve.

When the apparatus is in operation, compressed gas enters the casing H and acts on the differential piston A B against a load determined by the dead-weight of the parts and the pressure on the diaphragm as regulated by the governor. Any excess of pressure above the load will lift the piston and allow gas to bye-pass through the outlet G to the compressor inlet. Should the gas supply diminish unduly, or fail, the pressure in the diaphragm chamber drops at once, thereby reducing the load on the valve, which consequently opens and avoids any risk of dangerous suction against the meter.

As the valve operates in the same manner whether or not gas is being supplied properly, means may be provided for indicating when the supply fails. This may be done by fitting a small pipe leading to a pilot jet (always burning) situated in a convenient place for observation, so that the lowering or extinction of the flame would indicate the occurrence of abnormal conditions. Alternatively, the pipe may be fitted to a pressure gauge, to be used alone or arranged to operate an audible alarm by closing an electric circuit.

LEGAL INTELLIGENCE.

TELEPHONE POLE RENTS AT NEWMARKET.

His Honour Judge Farrant, sitting in the Newmarket County Court, heard an application under the Telegraph Act, 1878, and the Telegraph Construction Act, 1916, in which the question at issue was whether the Newmarket Gas Company could demand increased rents for three telephone poles on their premises, or have the poles removed, in accordance with notice given by them in the terms of the agreement. It was stated that the poles carried subscribers' circuits, and also junction wires between Newmarket and Exning. They were erected by the National Telephone Company in 1896, on consent given by the Gas Company, which provided for a payment of 1s. per annum, increased in 1901 to 1s. per pole. The telephones were taken over in 1912 by the Postmaster-General, who had continued the payment. In April of last year the Gas Company protested against the increase in telephone rates, declined to renew their agreement, and gave notice that the rent required for poles would be increased to 5s. each pole, failing agreement to pay which sum six months' notice was given to remove them. The poles were adjacent to the road, the first being inside the yard, the second in the corner of the manager's garden, and the third on a piece of waste ground further along the road and near a gasholder. In the original agreement, the Telephone Company undertook to remove the poles when given due notice. Mr. J. H. Troughton (Manager and Secretary to the Company) said there were at first very few wires on the three posts; but now there were a large number. It was not a fact that the whole business was only retaliation for the increased telephone charges. They had thought for a long time that 1s. was an inadequate rent. His Honour said he would deal with the case on what he conceived to be its merits. He believed it to be in the public interest that the poles should remain in their present positions. Having regard, among other considerations, to the effect on the amenities and value of the land, he ordered payment of 11s. per annum by the Postmaster-General to the Gas Company—5s. in respect of the pole in the garden of the manager, and 3s. in respect of each of the other two poles. The Gas Company were allowed costs on Scale B and special items.

THE YEOVIL EMBEZZLEMENT CHARGE.

George Fenwick, aged 33, the ex-Yeovil Corporation Gas Manager, pleaded guilty at the Somerset Quarter Sessions, last Wednesday, to embezzling £416, the moneys of the Corporation, and £156 received by him on account of the Corporation.*

Mr. F. E. WETHERLEY (prosecuting) said that accused had been the trusted servant of the Corporation, and had been receiving £350 a year salary. The embezzlement of the larger sum was effected through the handling of money from cheques drawn for wages, and taken from time to time from the safe in which the cash from the slot-meters was kept. For the sums taken, the accused left I.O.U.'s in the safe. He understood that accused had been spending a lot of money. He had offered to give up two valuable motor-cycles as some form of restitution to his employers.

Mr. WETHERED (on behalf of the accused) said he was badly wounded and gassed during the war. It was unfortunately true that the cause of his downfall was the spending of money on a woman who was not his wife. His married life had been very unhappy.

Accused was sentenced to four months' imprisonment in the second division.

The CHAIRMAN remarked that he had been treated leniently because there were extenuating circumstances, and there was no falsification of accounts.

* See "JOURNAL," Vol. CLVI., p. 634.

PARLIAMENTARY INTELLIGENCE.

PARLIAMENTARY BILL NOTICE.

Chester United Gas Company.

Notice was given in last Friday's "London Gazette" of the intention of the Chester United Gas Company to apply to Parliament in the ensuing session for an Act to enable them to substitute for the existing maximum price of gas and maximum rates of dividend a basic or other price and rates of dividend; to provide for varying prices in different parts of the Company's limits and in different cases; to permit the application of a share of profits to employees in connection with, or based upon, reduction in price to consumers; to increase the borrowing powers of the Company; to authorize profit-sharing or co-partnership; and to regulate the supply of gas and the administration of the Company.

MISCELLANEOUS NEWS.

GAS REGULATION ACT ORDERS.

There have been forwarded by the Director of Gas Administration copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

Eckington and Mosbrough Gas Company, Ltd.

As from the declared date, the maximum price in respect of gas supplied by the undertakers shall be 18d. per therm, and so in proportion for any less quantity supplied, provided that every fraction of one-half of a therm may be charged as one-half of a therm. (Dec. 29)

Gravesend and Milton Gas Light Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 19d. per therm.

For the purpose of ascertaining the authorized rate of dividend for the year in which the declared date occurs, the price charged per 1000 c.ft. during that part of the year (if any) before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-one-fifth.

Prepayment meter clauses are included. (Dec. 30.)

GAS REGULATION ACT APPLICATION.

The following further notices have appeared in the "London Gazette" under the Gas Regulation Act.

SPECIAL ORDER.

Borough of Torquay (St. Mary Church Gas-Works).

Notice is given by the Borough of Torquay of their intention to make application to the Board of Trade for a Special Order under section 10, authorizing them to instal additional plant for the manufacture of carburetted hydrogen gas upon a specified piece of land in the parish of St. Mary Church, and to acquire further land for the purposes of their gas undertaking.

DECLARATIONS OF CALORIFIC POWER.

Abingdon Gas Light and Coke Company, Ltd.—450 B.Th.U. (Dec. 30.)

Chasetown Gas Company.—500 B.Th.U. (Jan. 2.)

Great Grimsby Gas Company.—450 B.Th.U. (Dec. 31.)

Huntingdon and Godmanchester Gas and Coke Company, Ltd.—480 B.Th.U. (Dec. 31.)

Swansea Gas Light Company.—450 B.Th.U. (Dec. 31.)

ORIGIN, OBJECT, AND APPLICATION OF THE THERM.

To good purpose—for he evidently succeeded in making his hearers clearly understand his subject—Mr. J. M. CAMPBELL (the Engineer and General Manager of the Isle of Thanet Gas Light and Coke Company) recently delivered an address to the members of the Margate Rotary Club on "The Therm: Its Origin, Object, and Application." Such explanatory addresses as this are of great use at the present juncture; and no doubt Mr. Campbell will find himself amply rewarded by the amount of good which will result to his Company from the clearing-up in this way of many misapprehensions that existed previously.

Though necessarily of a more or less elementary nature, the address went thoroughly into the matter. Mr. Campbell began by pointing out that the war has had the effect of changing almost everything, with the result that opinions which were only tentatively suggested prior thereto are now accepted as a matter of course, while subjects that in 1914 interested only the crank or specialist have now become of more or less general interest. Prior to 1914, coal was plentiful, cheap, and of good quality as a rule, with the result that it was wastefully used, and the study of economy or conservation was disregarded by both the general public and the authorities. During the war, however, when the price of coal was advancing rapidly, with its quality becoming worse and the quantity more scarce, the Government appointed a Committee (termed the Fuel Research Board) to investigate

the question, and to make suggestions as to the most economical methods of usage whereby this vital commodity might be conserved.

Gas undertakings, he went on, consume roughly 18 to 20 million tons of coal in a year; and it was inevitable that considerable attention should be paid by the Fuel Research Board to the most convenient and serviceable way by which coal might be employed in the operation of the manufacture of gas, in view of the large quantity involved. It was recognized by them, as it has been by many scientists and others, that the consumption of raw coal in an open grate conduces to the pollution of the atmosphere, besides imposing a distinct loss upon the community by the various valuable products passing up the chimney, which would be preserved by the coal being carbonized on the works of a gas undertaking. The Fuel Research Board realized at an early stage of their proceedings that gas undertakings might, under certain conditions, be able to effect additional economies in the use of coal by being permitted a greater amount of freedom in the quality and composition of the gas to be supplied.

Whereas in former times gas was employed almost entirely for the purpose of illumination, the calorific value is now the essential factor. In spite, however, of this, all gas undertakings have been until within quite recent years obliged to conform to a standard of illuminating power which was becoming year by year more antiquated and useless by reason of the greater extent to which gas was being used for its heating value; and to this the Fuel Research Board devoted much consideration in their inquiry.

His own Company, said Mr. Campbell, in 1914 succeeded in securing the change from the obsolete illuminating power standard to that of calorific value. The standard fixed in their case appeared likely to be adopted by Parliament as the universal figure; but the Fuel Research Board recognized that a uniform heating standard throughout the whole industry would, on account of the variations in manufacturing conditions, differing character and costs of coals, local conditions, and many other matters incidental to gas manufacture, create a more or less dissatisfied industry, and would not make for either economy or progress. Gas is not made exclusively from coal, as coke and oil are employed in a large proportion of works for the manufacture of carburetted water gas; while the local conditions applying to a gas undertaking must also have an important bearing on the question of the character and composition of the gas to be supplied. Hence the unwisdom of establishing throughout the industry a uniform heating standard. The Fuel Research Board, recognizing this, recommended in their report that each undertaking should be at liberty to supply the quality of gas best suited to its particular circumstances. Having reached this conclusion, it was felt that, in order effectively to protect the consumer, some alteration should be made in the method of charging for the gas consumed, and this involved the introduction by the Fuel Research Board of what is now known as the "therm."

Proceeding to explain the change-over from cubic feet to the therm basis of charging, the author pointed out that this new system has been made compulsory on all gas suppliers by the Gas Regulation Act. It has not been introduced by (say) the local company, merely as a subterfuge to exact further sums from the pockets of the already harassed consumer, as has been suggested in one or two cases elsewhere. The Act provides that, if any gas undertaking has not applied to the Board of Trade within two years after the passing of the Act, the Board of Trade may themselves make an Order, applying it to the undertaking after giving not less than three months' notice. It will thus be seen that it is absolutely compulsory on the part of gas undertakings to adopt the provisions of the Act by making application in the prescribed way, or waiting for the Board of Trade to apply it to them within two years after the passing of the Act. No suspicion must therefore attach to any gas undertaking for coming within the scope of the Act, which has for its main object the protection of public interests, and to secure that the gas consumer gets what he pays for by the establishment of a permanent quality at the cheapest possible rate.

Referring to the declaration of heat value which each undertaking is obliged publicly to announce, Mr. Campbell explained that this must mainly depend on the character of the coal which can be most economically purchased, together with the results to be secured by its carbonization with the manufacturing plant locally installed for the purpose. The Fuel Research Board conclusively elicited the important fact from their witnesses that, to secure the best results in consuming gas, it was not only unnecessary, but in many cases uneconomical, to employ gas of a high heating value, and that better, or as good, results were secured to the consumer by gas of a lower calorific value than that which was prior to the war generally accepted as being necessary. It was demonstrated more clearly by the Government Departments when, owing to certain strikes and other disturbances, they were obliged to issue orders for the supply of gas of not more than 450 B.Th.U. per c.ft., without any real difference being apparent to the consumer. The gas consumer will, for the same money, receive more gas of a lower quality than he will if the quality be higher; and consequently comparisons can be made with perfect accuracy as to the prices ruling with one undertaking and another. No proper comparison could be made between the prices charged by two adjoining companies under the old basis of charge, in view of the variation in quality that might be supplied by the respective undertakings. It is, Mr. Campbell continued, his Company's intention to declare 460 B.Th.U. as the quality to be supplied locally.

After referring briefly to the question of testing, he went on to deal with the provision in the Act that additions shall be made to the standard price of gas to cover unavoidable costs caused by the war—citing his own Company's case as a typical example. In their case, it is decreed that, with the price of gas at 4s. 2d. per 1000 c.ft., which represents the standard, the rate of dividend shall be 3½ p.ct.; and for every 1d. alteration, the dividend shall slide only 2s. 6d. p.ct. The relative amounts of 1d. per 1000 c.ft. reduction to the consumer securing the additional 2s. 6d. p.ct. to the stockholder are, of course, in our case most disproportionate, by reason of the fact that the former would mean roughly £1500 per year saving to the consumers, as against about £160 for the general body of stockholders. For some years before the outbreak of war, the Company's price for gas was 2s. 4d. per 1000 c.ft., representing a reduction from the standard price of 1s. 10d., and entitling the stockholders to 22 half-crowns additional dividend on the standard basis of 3½ p.ct. This 6½ p.ct. dividend constituted the maximum distribution; and no further increase in dividend could be made unless the price of gas were further reduced. Similarly, by every increase in the price of gas the dividend became lower. This obviously created a considerable hardship to all stockholders in gas undertakings, as, owing to the increased cost of coal, labour, stores, renewals, &c., no gas company could possibly prevent rises in the price of gas; and, though these were not due to any absence of foresight or want of care on the part of the management or administration, the stockholders were obliged to accept diminutions in the return on their invested capital, owing to the operation of the sliding-scale.

The dividends distributed by his Company from 1914 until 1920 were reduced gradually, year by year, from 6½ to 3 p.ct. (less income-tax in each case). Last year, owing to the price advancing to 5s. 6d. per 1000 c.ft., they were only entitled to pay 1½ p.ct. (less income-tax), though by application to the Board of Trade under the Temporary Increase of Charges Act, 1918, they had been successful in securing an increase in this distribution to the magnificent figure of 2½ p.ct. (less income-tax). Parliament recognized this unfairness to the gas-investing public, and provided for such increases of the standard price to be made as appear to the Board of Trade to be reasonably required to meet any advances due to circumstances beyond their control, or which could not reasonably have been avoided; and this claim has to be embodied in the application made by each undertaking under the Gas Regulation Act.

In conclusion, the author said that periods of transition are always difficult; and this fresh system will for a time appear "uncanny," owing to the unfamiliarity of therms. But when the gas undertakings and the consumers become quite accustomed to the new conditions, there can, he thinks, be no doubt that the results will be satisfactory to all concerned, and more particularly to the consumer. In future all consumers will buy "heat," by a scientific combination of quantity and quality, with the definite assurance that their interests are most carefully safeguarded under the Gas Regulation Act.

Mr. WALTER HILLS (the Chairman of the Gas Company) followed with some remarks, in the course of which he said that the Company, during its history, now bordering on a century, had never had an Engineer and Manager comparable with Mr. Campbell. He referred also to the desire of the Directors to give the consumers a gas supply at the cheapest possible rate. The position of the consumer, he added, would be very much improved in the near future.

FINANCES AT STOCKTON-ON-TEES.

The Stockton-on-Tees Gas Committee's policy was severely criticized at the Corporation meeting on Tuesday of last week. Slot-meter gas consumers protested that they were now paying at the rate of 5s. 7½d. per 1000 c.ft., while other consumers were only charged 4s. 11d. The Committee had decided to allow a discount of 5 p.ct. to slot-meter users.

The ENGINEER (Mr. W. W. Atley) presented a financial statement in regard to the installation of horizontal retorts at the works. He said the loan for which sanction had been obtained for this work was £51,295, and a further sum of £14,115 was required to complete it. Because the work had cost more than anticipated and the loan was exceeded, the Committee recommended that, instead of an application for a further loan, a suspense account should be opened to which this expenditure should be placed, and that such an account be credited over the next five years with a significant sum to discharge the whole amount within that period, if the accounts from time to time should permit.

Mr. ALLISON wanted to know how far the excess of expenditure over estimate was justified. He moved that application should be made for a further loan, so that a public inquiry might be made into the reasons for the excess.

Mr. DUNN, who seconded, said it was a new experience so far as the gas-works were concerned; but it would be better to make a clean breast of the thing than try to pay it out of the profits over a period of five years.

Alderman NATTRASS suggested that as Mr. Allison and Mr. Dunn were absent from the Gas Committee meeting at which the recommendation was decided upon, the whole matter should be referred back for fuller consideration. The Committee were evidently optimistic enough to think the trade would revive and conditions so improve that they would be able to pay the money out of revenue in five years. If the other course were adopted, and the money was borrowed, it did not get rid of the liability.

It was decided that the question should go back to the Committee.

Hornsey's Cheap Gas Supply.—The consumers of the Hornsey Gas Company are to be congratulated—as is also Mr. J. W. Buckley, the Engineer and General Manager—upon the fact that it has been found possible to make a reduction in the price of gas from 11½d. to 11d. per therm—a figure which can only be regarded as exceedingly favourable, especially under the prevailing conditions of high costs.

Gas Charges at Neath.—The Neath Town Council have adopted a recommendation of the Gas Manager (Mr. W. C. Jackson) that the price of coke be reduced by 3s. 4d. to 36s. 8d. per ton; but Mr. Jackson said he considered it would be unwise to interfere with the price of gas during the present quarter. If, however, the thermal system could be introduced, he was of opinion that a reduction could be effected by the next quarter. Regret was expressed by several members that the Gas Committee did not see fit to recommend an immediate reduction in price, in view of the lower cost of coal and the decrease in wages; but the Chairman said the difficulty was the deficiency on the undertaking, which was a serious matter. One member stated that, owing to the high cost of gas, most of the working classes were reverting to the use of oil-lamps. It was understood that the Committee would reduce the charges in April.

TAXING IMPORTED ILLUMINATING GLASSWARE.

Applications Under the Safeguarding of Industries Act.

The Committee which has been appointed under Part II. of the Safeguarding of Industries Act to inquire into complaints as to the dumping of illuminating and other glassware, heard evidence on the question of illuminating glassware on Wednesday last. The National Gas Council in opposition to the demand for a tax are co-operating with the China and Glass Section of the London Chamber of Commerce; and the whole of this opposition was represented before the Committee by Sir ARTHUR COLEFAX, K.C., and Mr. EVANS, M.P. The procedure before the Committee is that counsel may appear and address the Committee, but must not cross-examine witnesses or put questions even to his own witnesses. Thus the witnesses have been examined by the Committee on proofs of evidence which have previously been supplied.

Mr. *James Bateman* (of Messrs. M. Bateman and Co., glass merchants and importers) dealt specially with illuminating glassware. Before the war there were three well known lines—viz., "Jena," "Resisto," and "Monopel." These were of the highest quality, though there was a lot of inferior glass on the market for which there was no great demand among the better-class houses. Messrs. Chance Bros. in their evidence had said that they had a monopoly of the business of the South Metropolitan Gas Company, and also of the James Keith and Blackman Company and Messrs. William Sugg & Co., Ltd.; and it was incidentally mentioned that the firm were receiving a price of 50 p.ct. more than that of imported illuminating glassware. The Committee had also been informed that the South Metropolitan Gas Company were the firm's best customer, and also that, owing to foreign competition, their sales had dropped. As a matter of fact, continued Mr. Bateman, since the war the "Monopel" and "Resisto" people had not manufactured a single article, and the "Jena" people very little. The "Resisto" makers certainly had some stock, manufactured before the war, which might have been sent to this country; but Messrs. Chance Bros. appeared to have secured practically all the trade that was available in these lines. With further reference to heat-resisting glassware, he understood that the Oesterreichisch-Glashuetten Gesellschaft, who were the manufacturers of the "Monopel" brand, had increased their price by 100 p.ct.; but they had been able to dispose of very little of this glassware. Messrs. Chance Bros. had also suggested to the Committee that heat-resisting glass was coming into this country from Japan, France, and Sweden. But Japan and Sweden did not manufacture heat-resisting glass, and France made it in very small quantities, and not of very high quality. Their prices were governed commercially; and they were only able to supply here at times, owing to the difficulty of obtaining supplies here during the war and shortly afterwards. His firm had been the agents for "Monopel" glassware. There had been an extraordinary falling-off in the requirements for this heat-resisting glassware; and as Messrs. Chance Bros. claimed to have secured 90 p.ct. of the business here, it appeared that they now wished to have a tax imposed, so that they could get the remaining 10 p.ct. and so secure a monopoly. During the three or four years immediately preceding the war the demand for heat-resisting cylinders and globes for electric arc lamps rapidly declined, consequent on the strides made with high-pressure gas lighting, and the development of the half-watt lamp. The arc lamp system of lighting was now practically dead; and high-pressure gas lighting reached its zenith just prior to the war. During the war, owing to the restrictions upon lighting and the difficulty of obtaining supplies of heat-resisting glassware, many lamps were put out of use; and when the restrictions were removed, it was only possible to obtain sufficient supplies of glassware to enable existing installations to be restored. This having been done, orders became scarcer, and, owing to the slump in trade, there was now very little business being done. In fact, one of his pre-war customers had told him that the demand in quantity had dropped in 1921 by 75 p.ct. compared with 1920—*i.e.*, taking 1920 as 100, the demand in 1921 was only 25. During the same period the drop in value was represented by 100 and 60 respectively. This appeared to prove conclusively that Messrs. Chance Bros.' difficulties were not due to imports, but to the general slump in trade. He agreed that the South Metropolitan Gas Company were the largest customer in the trade for this type of glassware.

The CHAIRMAN: You tell us Messrs. Chance Bros. appear to have secured all the trade that is available in this line; and therefore I suppose that means that your trade in this particular branch has come to an end?

Witness: Absolutely.

And the situation, so far as your business is concerned, is that all that the South Metropolitan Company and Messrs. Keith purchased from you before the war they now buy from Messrs. Chance Bros.?—Yes, they said so in their evidence.

And your contention is that the troubles of which Messrs. Chance Bros. complain are not due to imports but to the general decline in the demand in the lighting trade?—Yes.

Answering Sir THOMAS ALLEN as to the reason why Messrs. Chance Bros. obtained a price 50 p.ct. higher than that of imported glass, witness said he could only assume that it was done by the South Metropolitan Gas Company to encourage British industry. The quality of the goods which he had previously supplied to the Company had never been complained of. His point was that, having secured 90 p.ct. of the business here, Messrs. Chance Bros. had quite a sufficient share without asking for further protection—indeed, he regarded 90 p.ct. as more than sufficient.

In reply to Sir JOHN BARRAN, witness remarked that he did not handle electric globes. He had, however, recently been in communication with someone in the trade, and had been told that although the works at Leamington could supply all the demands in this country, they had recently had to discharge 120 men because of lack of orders. No incandescent electric lamp bulbs were being imported into this country; but the finished lamps were. This business, however, might now be stopped by the recent Court of Appeal order.

Replying to further questions, witness pointed out that Belgium did not make heat-resisting glass; most of it came from Austria. At present, the English makers were supplying his old customers direct. He had tried to get the agency for Messrs. Chance Bros.; but they had done the business themselves direct.

Mr. *S. S. Ogilvie*, Joint Manager of the National Gas Council, said the Council were acting in co-operation with the London Chamber of Commerce in this matter. On Jan. 11, 1921, when considering this whole question, the Council had passed a resolution that: "The free import of such articles as gas-mantles and heat-resisting glass is essential to the industry." The Council was strongly opposed to any duty being placed upon glassware used in the industry. This glassware consisted of heat-resisting glass and semi heat-resisting glass. Heat-resisting glass was used for high-pressure globes, ordinary chimneys, mantle protectors, and for shop lamps. Semi heat-resisting glass was found in the ordinary gas-globes, and was often etched and coloured. So far as heat-resisting glassware was concerned, it was estimated that the gas companies used and sold about £80,000 worth per annum; but this did not include the glass sold in connection with gas in the small shops and by ironmongers, which would probably amount to about another £40,000 per annum. In this connection, he pointed out that the local authorities who owned gas-works were also the public lighting authorities, and this accounted for their large use. The value of the semi heat-resisting glassware sold and used by the gas undertakings was about £25,000 per annum, also apart from that sold by the shops. The price of glassware had increased by about 150 p.ct. over the pre-war figure; but it was impossible for the British makers to supply a fraction of the total demands of the industry. Moreover, it was generally recognized that the quality of British heat-resisting glassware, with a few exceptions, did not compare with that coming from abroad. If a higher price was charged for illuminating glassware, which was already too costly, there was no doubt that fewer burners would be furnished with the glass. Where possible, they would be used naked. There would also be a tendency for the number of lights to be reduced, and so diminish the quantity of gas used. Indirectly, therefore, there would be a falling-off in the output of gas and in the maintenance of burners, which must tend to the employment of fewer men in the gas industry. He had noticed that Mr. Bassett, for Messrs. Chance Bros., had said that he was much impressed with the loyalty of the gas companies to the new British glass industry. He himself did not know how many gas companies still purchased from British glass manufacturers, and, of course, the National Gas Council did not desire to interfere in any way with the placing of their orders. At the same time, it must not be inferred from Mr. Bassett's evidence that the gas industry was in favour of a duty being placed upon foreign glassware for the purpose of assisting British industry. Further, Mr. Bassett, in the course of his evidence, had said—so he read in the "GAS JOURNAL"—that gas lighting was a declining industry, and that this accounted for the falling-off in the demand for this type of glassware. As a matter of fact, the chief factor with regard to the declining use of glassware for gas lighting was the excessive price; and a consumer would rather extinguish a burner or two than buy high-priced glassware.

At the request of the CHAIRMAN, witness explained the operations of the National Gas Council in some detail. The only large gas companies outside the Council were the South Metropolitan, the South Suburban, and the Brighton and Hove Companies, and the largest local authority was Oldbury. The Council were now recognized by the Government as the body representing both the technical and the commercial interests of the industry.

The CHAIRMAN: Are there represented on the Executive such large towns as Liverpool, Manchester, and Birmingham?

Witness said that was so.

The CHAIRMAN remarked that, considering how divided opinions were upon a matter of this kind among the great corporations, the Committee would like to be quite sure that the representatives of the great corporations on the National Gas Council were properly empowered to act on their behalf when the Council passed such a resolution as that which had been referred to. The resolution was as far back as January, 1921—before this Committee was formed.

Witness said he could produce a certified copy of the resolution or the minute book.

The CHAIRMAN expressed a wish to have a certified copy, and asked if the question of heat-resisting glass had been discussed since the resolution was passed.

Witness said the subject had been dealt with in connection with gas-mantles; and the principle laid down in the resolution had been upheld. The evidence of the Council had been accepted by the Referee under Part I. of the Act in relation to gas-mantles.

Speaking with regard to the statement that Messrs. Chance Bros. had secured 90 p.ct. of the trade in heat-resisting glass, witness said he could not understand this, and cast doubt upon it. He was satisfied that Messrs. Chance Bros. might sell 90 p.ct. of the heat-resisting glass manufactured in this country; but he did not think they were supplying 90 p.ct. of the total demands in the country.

Mr. *Bassett*, representing Messrs. Chance Bros., was recalled by the CHAIRMAN to explain the point. He said he had divided the glass into three sections—viz., large-size globes, medium-size globes, and small globes and cylinders. The evidence had been that his firm were getting 90 p.ct. of the trade in large globes which were used for outside lighting in the streets of London. This was a very small percentage of the whole of the heat-resisting glass trade in this country. The part of the trade in which there was very severe competition from Germany and Czecho-Slovakia was in the smaller sizes. They were getting a small percentage of the trade in medium-size glass. As a matter of fact, they were doing no business at all in the smaller sizes, owing to foreign competition.

Mr. *Ogilvie* was then further questioned by the members of the Committee. Asked as to where the members of his organization obtained their glassware, he said that some came from Jena; but he could not give full information at once.

Sir THOMAS ALLEN put it that the £145,000 worth of glass referred to in witness's evidence as the total required by the gas industry was a small figure to suggest that the British manufacturers could not supply.

Witness said that was a very low estimate which he had put in so that he should not over-state the case. The quantity sold by shops and ironmongers was very large—much more than that purchased by the gas authorities themselves for street lighting and other purposes.

Sir THOMAS ALLEN: In the absence of these figures, how do you come to the conclusion that British makers cannot supply the demand?

Witness pointed out that the figure was an estimate, and a low one. It all depended on the number of furnaces the makers had. Messrs. Chance Bros. were the only British firm making a quality of glass which was of value to the gas industry.

You say that there is only one firm here whose glass is of a quality comparable to the foreign, and it is not possible for them to turn out a fraction of what is required in this country?—That is so.

Mr. AITON put a number of questions directed to the point that if there is unemployment in this country among glass workers, it must lead to less gas consumption. Would not the effect of this be even worse than the reduced consumption of gas, as suggested, through less use of glassware owing to the high price of the latter.

Witness admitted that there would necessarily be a reduced consumption of gas on the part of glass workers who were unemployed, but only to a certain extent. It was only possible to argue on general grounds in dealing with this new situation which had arisen. The point he wished to make was that there would be serious unemployment in the gas industry consequent on the less sales, because people used less gas owing to the high price of glassware through a tax being imposed. He did not agree that the less sales of gas due to glass workers being unemployed would be more serious than the reduced consumption, because the general population could not afford to pay high prices for glass in connection with the use of gas.

Sir JOHN BARRAN took up the question of the manner in which the National Gas Council had discussed this matter, and the extent to which they could pledge their members to any resolution.

In reply to a long series of questions, witness explained that, owing to an oversight, the question of heat-resisting glass was not put on the *agenda* for the meeting of the Council on Dec. 13—the day after the Committee first met. On Dec. 23, however, he sent out a circular letter referring to the matter, and asking whether the individual Councils would agree to the National Gas Council working in co-operation with the London Chamber of Commerce. To this letter he had received a large number of favourable replies, and only two against. There was one neutral reply. Since then, he had sent out a further letter, saying that, in the absence of any communication to the contrary, he should assume that the corporation or company in question were agreeable to the adoption of the course suggested. He proposed sending all the replies to the Committee.

Sir JOHN BARRAN emphasized the point that this action had been taken several weeks after the Committee held their first sitting, and that there had therefore been very little time for the various companies and corporations to give the matter adequate consideration.

Witness replied that the whole question had been before the members since the January resolution. They had also been kept in touch with what had been going on through the medium of the Council's monthly "Bulletin:" and he felt he was entitled to draw the inference that those who did not reply to his circular letter of Dec. 23 were in favour of what was being done. Colchester and York were the two corporations who did not agree.

Sir JOHN BARRAN again put it that there had not been time for the various bodies to consider the matter and formally signify their views.

Witness contended that there had been ample opportunity for them to know the views of the Central Executive Committee, following the January resolution; but if the Committee desired it, he would bring the matter before the Executive Committee again at their next meeting. The position at the moment was as he had stated, and he would welcome any suggestion from the Committee as to what they thought ought to be done.

Sir JOHN BARRAN explained that he was anxious to get at the grounds of the support upon which the National Gas Council were proceeding. He did not make any suggestion that the proper steps had not been taken, but was anxious to make sure that the Executive Council really did, in this matter, represent the views of members.

The CHAIRMAN then took the matter up, and said that one of the peculiar difficulties of the situation was that 600 of the members of the National Gas Council were companies. He took it that the representation on the Executive Council was in the same proportion.

Witness: That is not so. The representation on the Executive is about half and half.

The CHAIRMAN remarked that while he could understand that it was quite natural for the representative of a company to commit his company in a matter of policy, it was different in the case of the representative of a corporation to do so on a question of general policy such as this, and therefore there should be specific replies on the question in regard to the circular letter of Dec. 23 in each case.

Witness agreed with that in law; but in fact he had no doubt that the members of the Executive Council did really represent the views of their corporations or companies as the case might be.

The CHAIRMAN: You wish us to understand that the great city councils are speedily made cognizant of the action of their representatives in these matters?

Witness: I have no doubt about it.

In reply to Mr. AITON, witness admitted that it was quite his own fault that the National Gas Council did not discuss this matter specially on Dec. 13; and they could blame him for this if they wished. If the Committee now thought there was any doubt about the question, he submitted that they should say he must place the matter before his Executive Committee.

Mr. AITON remarked that the thing that occurred to him was that if this was such a very important matter, and the National Gas Council was such a very important association, it would have been discussed quite early. The appointment of the Committee was noted in the public Press; and it was a matter which he should have thought could not escape being discussed by the Executive Council.

Witness pointed out that it would have been discussed if he had put it on the *agenda* for the December meeting. With all respect, he suggested that these questions were not relevant, because the matter had been discussed and the January resolution passed. If nothing at all had been done, these questions would have been relevant. In any case, he could not say anything fairer than that he would bring the matter before the next meeting of the Council.

The CHAIRMAN, in bringing the cross-examination to a close, said to witness: You will put in the documents we have referred to. The Committee will not have ended its proceedings by the date of the next meeting of your Council; and it is open to the body you represent to take what action it pleases, and it is open to you to put in any further resolutions you desire, and the Committee will then consider them.

The evidence for the opposition will be continued on Tuesday next Jan. 10.

LEEDS UNIVERSITY LECTURES.

Department of Coal Gas and Fuel Industries with Metallurgy.

In connection with the work of the Department, arrangements have been made for the delivery, during the second term of the session 1921-22, of the following special courses of evening lectures.

I.—THE MANUFACTURE OF COAL GAS.

Dr. H. G. COLMAN.

A course of twelve lectures will be given by Dr. H. G. Colman, D.Sc., Ph.D., F.I.C., of London, on Fridays at 6 p.m. and 7.15 p.m., commencing Jan. 20, and concluding Feb. 24.

SYLLABUS.

A general description of the plant and processes involved in the manufacture of coal gas and carburetted water gas. Horizontal, inclined, and vertical retorts. Construction of retort-settings. Methods of maintaining uniform temperatures throughout the retorts, with simultaneous economy in fuel consumption. The initial treatment of volatile products evolved from the retorts. Hydraulic and dry mains. Condensation. Elimination of tar fog and naphthalene. Exhausters. Wet and dry purification. Cyanide recovery. Other bye-products—*e.g.*, coke, tar, benzene, toluene, ammoniacal liquor, &c. Manufacture of ammonium sulphate. Spent oxide. Spent lime, &c. The manufacturing and carburetting of water gas. The analytical control of gas manufacturing processes. Discussion of recent advances in, and new requirements for, public gas supply.

Fee for the course, £1 1s.

Ia.—RECORDING GAS CALORIMETERS.

Mr. J. W. WOOD.

Two lectures will be given by Mr. J. W. Wood, M.Sc., A.I.C., Research Chemist to the Gas Research Committee of the Institution of Gas Engineers and the University, at 6 p.m. and 7.15 p.m. on Friday, March 10.

SYLLABUS.

The lectures will deal with the principles applied in the construction of recording gas calorimeters (Beasley, Simmance, Thomas, and Fairweather instruments), the sources of error and methods of use.

Fee for the two lectures, 5s.

II.—REFRACTORY MATERIALS.

Prof. J. W. COBB.

A course of eight lectures will be given by Prof. J. W. Cobb, C.B.E., B.Sc., F.I.C., of the Leeds University, on Tuesdays, at 6 p.m. and 7.30 p.m., commencing Jan. 17 and concluding Feb. 7.

SYLLABUS.

Physical and chemical principles on which the manufacture and use of refractory materials are based. Consideration of raw materials available and manufacturing processes. Choice of refractory materials for use in furnaces of different types. Methods of testing.

Fee for the course, 10s. 6d.

III.—METALLURGY.

Mr. P. F. SUMMERS.

A course of six lectures on the microscopic study of engineering alloys, followed by practical work in the laboratory, will be given by Mr. P. F. Summers, A.R.S.M., on Wednesdays, at 6 p.m., commencing Jan. 18 and concluding Feb. 22. The course will be divided into two parts, which may be taken separately.

PART 1. GENERAL (three lectures, with laboratory work).

An introduction to the metallographic study of engineering alloys, their preparation and examination.

PART 2. SPECIAL (three lectures, with laboratory work).

The microstructure and heat treatment of bronzes.

Fee for each part (including laboratory work) 7s. 6d., together with a deposit (returnable) of 10s. to cover breakages.

IV.—EVENING LABORATORY COURSE.

Prof. COBB, Mr. HODSMAN, and Mr. SUMMERS.

The laboratory of the Department will be open on Wednesday evenings between 6 p.m. and 9 p.m., from Jan. 18 to Feb. 22, for a limited number of students who have already received some chemical training, but who desire instruction in Fuel Calorimetry and Pyrometry. More advanced students, capable of independent work, may also be admitted to the laboratory during these periods.

Fee, 10s. 6d., together with a deposit (returnable) of 10s. to cover breakages. The earliest possible application from intending students is requested.

V.—DAY LECTURE CLASSES.

For information respecting the day lecture courses in the Coal Gas and Fuel Industries Department of the University—namely, pro-

perties of gases, technology of fuel, general and non-ferrous metallurgy, iron and steel, and alloys and metallography—see the special prospectus of the Department, obtainable on application to the Registrar.

VI.—ADMISSION OF STUDENTS, INQUIRIES, &c.

Intending students are requested to send in their names without delay to the Registrar of the University, specifying at the same time what course or courses they wish to attend. Other inquiries regarding the courses should be addressed to Prof. Cobb, the Head of the Department of Coal Gas and Fuel Industries (with Metallurgy).

The University reserves the right to decide that any course shall not be given, if the number of entries is inadequate. In view of the demands on the University accommodation, the earliest possible application for admission to the day courses, commencing October, 1922, is advisable.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan.* 9.

There is more inquiry for pitch at present, and the market has a decidedly firmer tone. The price is steady at 62s. 6d. per ton net f.o.b. makers' works. A moderate amount of business is being done in creosote, at prices ranging from 6½d. to 7d. per gallon. Solvent naphtha is somewhat quiet; makers' price for 95/160 quality being from 3s. to 3s. 3d. per gallon. Pure benzole and pure toluole are steady at from 3s. 3d. to 3s. 6d. per gallon. There is more inquiry for pyridine bases; the price being steady at about 6s. per gallon.

In other products there is nothing fresh to report.

Tar Products in the Provinces.

Jan 9.

The average values for gas-works products during last week were: Gas-works coal tar, 37s. 6d. to 42s. 6d. Pitch, East Coast, 50s. to 52s. 6d. f.a.s. and 55s. to 57s. 6d. f.o.b.; West Coast—Manchester, 47s. 6d. to 50s.; Liverpool, 47s. 6d. to 50s.; Clyde, 50s. to 52s. 6d. Benzole 90 p.ct. North, 2s. 3d. to 2s. 4d.; crude 65 p.ct. at 120° C., 1s. 9½d. to 1s. 10½d. naked at makers' works; 50-90 p.ct., naked, North, 2s. 3d. to 2s. 4d. Toluole, naked, North, 2s. 10d. to 3s. nominal. Coal tar crude naphtha in bulk, North, 11d. to 1s. Solvent naphtha, naked, North, 2s. 3d. to 2s. 7d. Heavy naphtha, North, 2s. 3d. to 2s. 5d. Creosote, in bulk, North, liquid, 6d. to 6½d.; salty, 5½d. to 5⅝d. Heavy oils, in bulk, North, 8d. to 8½d. Carbolic acid, 60 p.ct., 1s. 6d. Naphthalene, £14 to £18; salts, £5 10s. to £6 10s., bags included. Anthracene, "A" quality, 7d. to 8d. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

The feeling in tar products is very depressed, probably owing to restrictions in the volume of business, brought about because sufficient raw material is not being produced for a large business. Such a situation should raise prices and also profits; but so far this has not happened, since the demand has fallen off just as much as the supply. Pitch is uncertain. Some makers take a gloomy view of the future and talk prices down to 35s. per ton. On the other hand, there are others who anticipate that 75s. per ton will be reached. Probably the real price is somewhere between the two—from 45s. to 50s. per ton. Carbolic acid shows no improvement. At the same time this material cannot be sold at a price which pays for its extraction, and many works have ceased production. One wonders what would happen were this product to be produced in normal quantities. There is no market for crystals, and even if the crude material could be extracted profitably, few people are able to buy the crystals at anything like the price which they cost to produce. There is not much demand for naphthalenes, particularly the refined quantities, although there is still a fair inquiry for crudes from the firelighter industry. Prices are unchanged. Solvent naphtha remains fairly steady, and has been sold at 2s. 9d. per gallon. There is not much fresh in intermediate products, and prices remain about as last quoted.

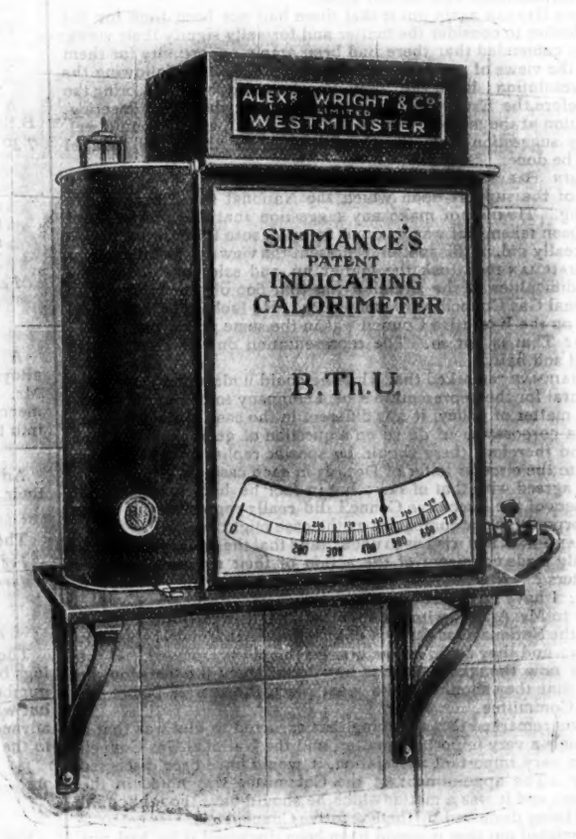
Sulphate of Ammonia.

The home demand for this material remains very poor. The imminence of the season for application, however, should shortly bring buyers into the market. The postponing of purchases until the last minute so far has not been rewarded by any reduction in prices. On the other hand, a considerable increase has taken place. This has caused a further consideration of the position by the consumer. Sulphate of ammonia is a material which can easily be stored; and the idea of the low prices in the early part of the season is to avoid congestion of orders when the season of application comes round. Farmers have only themselves to blame if they find they have to pay dearly for their delay and also have to wait their turn for deliveries. There is no doubt that present stocks of sulphate of ammonia are small. At the same time production is not great; and it might be that we shall be unable to get through the present season without importing.

From America it is reported that sulphate of ammonia has now become scarce, and buyers are finding it difficult to place their orders. The larger producers have sold their output for some time ahead. Considerable business has come into this market from Japan and other foreign buyers; and this has been largely instrumental in bringing about the present shortage.

The Porthcawl Urban District Council have resolved to borrow £3000 for the gas-works—£1200 for seven years, and £1800 for ten years. The money is to be raised locally.

CALORIFIC POWER AT A GLANCE.



Alexander Wright
& CO., LTD.,
WESTMINSTER, S.W. 1.

TRADE NOTES.

[For "Journal" Advertisers.]

An Extensive Advertising Scheme.

Everyone is acquainted with the "Welsbach" advertisements; but, even so, many people would be surprised to learn the number of newspapers and society journals circulating in the British Isles, in whose pages these announcements are to be found. We have just received from Palmer's Publicity Service a copy of a thirty-six page booklet relating to the Welsbach Light Company's general newspaper advertising scheme for 1921-22; and in this is given a list of newspapers, numbering more than eighty, in which advertisements of Welsbach mantles, Welsbach burners, and Welsbach-Kern radiators are appearing. Over thirty pages of the booklet are occupied by reproductions of the different announcements, and of a few of the artistic and attractive new show cards, window bills, blotters, &c., that have been issued this season. It seems that almost all the more important newspapers must be included in the long list referred to; and such a widely spread advertising campaign, carried out by means of well-selected illustrations, must be of benefit to the gas industry generally, as well as to the Welsbach Company in particular.

Price of Gas at Southport.

A notice of motion in the Southport Town Council, calling upon the Gas Committee to reduce the price of gas, had been withdrawn on the Chairman (Mr. Wright) pointing out that a report was in course of preparation by the Gas Engineer (Mr. John Bond). This report has now been submitted, and was before the Town Council at their meeting on the 3rd inst. The report is to the following effect: Two important facts which have to be taken into consideration with regard to the selling price of gas are the cost of material used in manufacture, and the wages paid throughout the department. The cost of coal and labour are now 150 p.ct. higher than in pre-war days; and the selling price of gas is double. It must not be forgotten that during the period from 1914 to the end of the financial year 1921, the average price of gas was 3s. 2d., less 5 p.ct., or approximately 26 p.ct. above the pre-war rate of 2s. 6d., though the Gas Department had to pay for various commodities essential to the conduct of the undertaking between 200 and 300 p.ct. more than in pre-war days, and the wages had increased by 180 p.ct. above pre-war rates. Unfortunately, at the commencement of the present financial year, the department were confronted with a three months' strike, which cost the undertaking £16,000 extra. It is not desirable that the price of gas should be reduced until after March 31 next, as it is essential that the Gas Estate should meet the whole of its liabilities, so as to place it on a sound footing for future work. The Gas Committee, having considered the present cost of production and the financial burden created by the coal stoppage, recommended that the price of gas be not reduced during the present financial year.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 31.]

Nos. 34,768 to 35,163.

ABBOTT, R. H. S.—"Destructive distillation of coal, &c." No. 34,941.

BOWN, H. C. & F. S. V. J.—"Gas economizer." No. 35,041.

BURT, BOULTON, AND HAYWOOD LTD.—"Apparatus for distilling coal tar, petroleum, &c." No. 34,846.

CHINA, F. J. E.—See Burt, Boulton, and Haywood, Ltd. No. 34,846.

DAVIDSON, T. M.—See Abbott, R. H. S. No. 34,941.

DAVIDSON, W. B.—"Apparatus for bringing liquids and gases, vapours, fumes, &c., into intimate contact." No. 34,804.

DAVIS, A. J.—"Carrier for gas-cylinder, &c., on vehicle." No. 34,900.

EWART, J. W.—"Gas-coppers." No. 34,857.

FERGUSON, A.—"Pipe couplings." No. 34,802.

GOEHTZ, H.—"Revolving grate for generators, furnaces, &c." No. 35,076.

GOEHTZ, H.—"Stationary flat grate for gas-producers, &c." No. 35,077.

HEAD, WRIGHTSON, & CO., LTD.—"Means for reciprocating conveyors or screens for coal, &c." No. 35,055.

HOLMES & CO., LTD., W. C.—See Davidson, W. B. No. 34,804.

LÜTSCHEN, E.—"Method of separating gaseous or liquid mixtures." No. 35,082.

METZGER, C.—See Lütschen, E. No. 35,082.

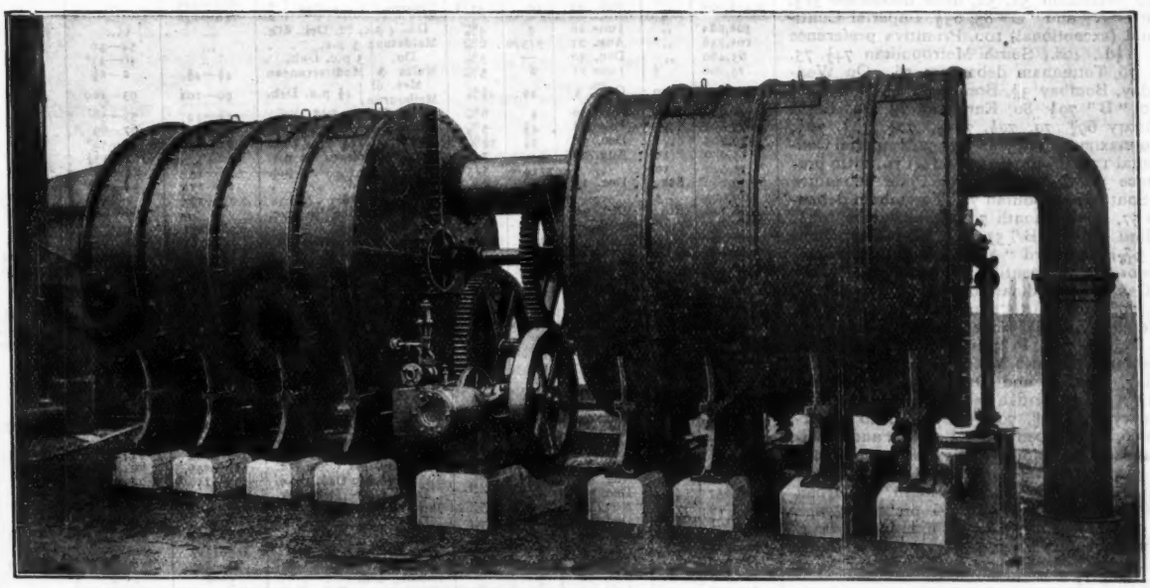
POTTERTON, T.—"Gas-heated boilers." No. 35,063.

SCHULZ, H.—"Regenerators for heating air or gas for combustion." No. 34,948.

SMITH, S.—See Davis, A. J. No. 34,900.

Co-Operation of the Ministry of Health Wanted.—Sir Arthur Duckham, interviewed by the "Evening Standard" on the trade outlook, expressed the opinion that this year would witness a gradual revival, and urged that development schemes should be put in hand. "Public authorities especially," he said, "should not wait in the hope of prices coming down further. There is no prospect that they will drop immediately, so far as this class of work is concerned. They should have their task made as easy as possible by the quick co-operation of the Ministry of Health. We have had in hand for the last six months an order for public work, which cannot be started because Government sanction has not yet been given; and until it gives the word, these people cannot go ahead. It amounts in money to between £40,000 and £50,000—a comparatively small sum, but one which is duplicated many times probably by similar delay in other cases.

ROTARY SCRUBBER WASHERS



MADE TO SUIT ALL REQUIREMENTS. LATEST IMPROVEMENTS.

R. & J. DEMPSTER, LTD., MANCHESTER.

LONDON OFFICE: 34, VICTORIA STREET, WESTMINSTER, S.W. 1.

Gas Cheaper at Rochester.—The Rochester, Chatham, and Gillingham Gas Company announce that, from the date of reading meters for the December quarter, the price of gas will be reduced by three-fifths of a penny per therm, which, together with the reduction that took place on Oct. 1 last, is equivalent to 4⅘d. per 1000 c.ft. under the old system of charge.

Responsibility for Gas-Meters.—The Bradford Health Committee have approved the action of a Sub-Committee in regard to a letter from the Ministry of Health with reference to the purchase of gas-meters from the Pudsey Gas Company for houses erected under the Bradford Moor and Thornbury housing schemes. The Ministry have been informed that, in the opinion of the Committee, gas-meters for the whole of the houses under the Corporation's various schemes should be charged against the Assisted Scheme, in view of the fact that locally the practice is invariably for the meters to be provided by the landlords.

Reduced Price at Walton-on-Thames.—Notification has been made to consumers within the area of supply of the Walton-on-Thames and Weybridge Gas Company of a reduction in the price of gas, from the date of the current reading of the meters, which is equivalent to 3d. per 1000 c.ft. The price of their gas (which until further notice is to be of a minimum calorific value of 450 B.Th.U.) will be 1s. 6d. per therm, which is equivalent to 6s. 9d. per 1000 c.ft.

Tully Plant at Redcar.—A 5 p.ct. discount has been decided upon at Redcar; and there is a prospect of further reductions. At a meeting of the Urban District Council last Wednesday, the Chairman of the Gas Committee (Mr. Hill) said the new Tully plant would be completed in about three weeks; and it was hoped that the adoption of this process, with the reduction in coal prices, would permit an increase of the discount for the present quarter to 10 or 15 p.ct. The system of payment by therm would, it was stated, come into operation in April.

STOCK MARKET REPORT.

THE Stock Exchange reopened on Tuesday for another abbreviated week of work, and soon bore evidence that it need not expect business to be oppressively heavy. In result, it was decidedly quiet, and for the most part dull; but at the close the tendency was better.

The gilt-edged market suffered from reduced prices. In Home Government issues, the big four were rather weaker, Friday's figures being thus: Consols 49⅞ 50¼, War Loan 91⅜ 92⅜, Funding 75½-76, Victory 81½-81⅞. Bonds participated in the movement, but new issues did fairly well.

Home Rails fluctuated in the ordinaries; but prior charges were in demand. Canadians were easier, and Argentines were irregular. The Foreign Market presented few strong points.

In the Miscellaneous Market, Rubber and Oil were under a cloud; but among the Industrials, improvement was apparent in Iron and Steel and in Textiles.

Business in the Gas Market showed a revival after the calm of the week before, but at least half of it was in Gas Light and Coke Issues. The tone of the market continued most favourable, and several quotations made further advances. In the London Companies, Gas Lights and South Metropolitan rose. Among the Suburban and Provincial group, Hastings and St. Leonard's 3½ p.ct. led the way with a rise of 11, and varying advances were made in Brentford, British, Newcastle, Southampton, Tottenhams, and Wandsworths. In the Foreign category, Imperial Continental was hardly touched and the quotation fell 1. San Paulo debenture advanced.

Bargains done for cash during the week were as follows; Monday being New Year's Day and a close holiday: On Tuesday, Bombay 3⅜. Commercial 3¼ p.ct. 60, European 6½, 6⅝, 6 11/16, 6⅝, Gas Light ordinary 69⅜, 70, 70¼, 70⅛, 70⅜, ditto maximum 51, 52, ditto debenture 51½, Ilford "A" and "C" 85, 85½, Imperial Continental (exceptional) 100, Primitiva preference 39s. 1½d., 40s., South Metropolitan 74⅞, 75, 75½, 76, Tottenham debenture 56. On Wednesday, Bombay 3⅜, Brentford "A" 79⅜, 80, ditto "B" 79½, 80, European 6⅝, Gas Light ordinary 69⅜, 70, 70⅛, 70 9/16, 70¼, 70⅛, 70⅜, ditto maximum 51, 51⅛, 51½, 52, Imperial Continental 137, Primitiva 12s. 6d., 13s., ditto preference 39s. 6d., 40s., River Plate debenture 44, South Metropolitan 76, Tottenham debenture 57, Bournemouth 7 p.ct. debenture 102½, Redhill 5 p.ct. "B" 55. On Thursday, Bombay 3 7/16, Brentford "A" 80, 80¼, British 24⅜, Buenos Aires debenture 46, European 6 11/16, 6⅝, 6⅞, Gas Light ordinary 69⅜, 69½, 69⅝, 69¾, 70, 70¼, 70⅜, 70½, ditto maximum 52, 52½, ditto preference 66, 66½, Imperial Continental 137, Lea Bridge 73½, Primitiva 13s., River Plate debenture 45, South Metropolitan 75½, 76. On Friday, Alliance and Dublin 52, 52¼, Brentford "A" 80⅜, British debenture 58, Gas Light ordinary 69⅜, 69¾, 70, 70⅛, 70¼, ditto preference 66, ditto debenture 51½, Malta and Mediterranean 2 1/16, Primitiva 14s., ditto preference 38s. 3d., South Metropolitan 75½, 76⅛, 77, ditto 6⅛ p.ct. debenture 103½, South Suburban debenture 73½, Tottenham 6 p.ct. mortgage 93⅜, 94, Aldershot 5 p.ct. maximum 62½, ditto 4 p.ct. debenture 62, 62½, Malta and Mediterranean 7 p.ct. preference 2½, ditto 7½ p.ct. 2nd preference 2⅛.

In the Money Market, there was a complete *volte-face* from the stringency which had characterized the week before, and the position rapidly developed a condition of marked ease which culminated at the close. Discount rates relaxed in agreement. Silver was very variable, rising and falling alternately from day to day. At the close it had risen to 34⅞d. The Bank rate is 5 p.ct., as fixed on Nov. 3.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.c.					
87,049	Stk.	Aug. 26	4	4%	Aldershot 4 p.c. Pref.	...	50—55	...
1,551,868	,,	Oct. 13	2½	3 1/16%	Alliance & Dublin Ord.	59—64	50—53	52—52½
374,000	,,	July 14	4	4%	Do. 4 p.c. Deb.	76—79	46—51	...
280,000	5	Nov. 30	7½	4/—	Bombay, Ltd.	5½—6½	2⅞—3⅜	3⅜—3 7/16
100,000	5	Aug. 11	16	4/7½	Bournemouth Gas & Water { 5 p.c.	...	7½—8½	...
383,110	10	,,	7	7/—	Bournemouth Gas & Water { B 7 p.c.	15—15½	8½—9½	...
115,000	10	,,	6	6/—	Bournemouth Gas & Water { Pref. 6 p.c.	13½—14	7½—8½	...
162,065	—	Dec. 30	—	4%	Bournemouth Gas & Water { 4 p.c. Deb.	...	54—59*	...
992,045	Stk.	July 15	14	56/—	Brentford A Consolid.	261—266	77—82	79⅜—80⅜
734,920	,,	,,	11	55/—	Do. B New	204—209	77—82	79⅜—80
55,000	,,	,,	5	5%	Do. 3 p.c. Pref.	109—111	68—72	...
221,400	,,	Dec. 15	4	4%	Do. 4 p.c. Deb.	91—93	60—62	...
214,775	,,	Aug. 26	11	10 4/9%	Brighton & Hove Orig.	208—213	130—135	...
244,200	,,	,,	8	7⅜%	Do. A Ord. Stk.	154—159	92—97	...
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max.	...	...	...
530,000	20	Sept. 29	12½	10%	British	44—45	24—26	24½
180,000	Stk.	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	57—62*	58
265,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	45—47	43—46*	46
100,000	10	May 27	—	6%	Cape Town & Dis., Ltd.	1½—2½	6½—7½	...
100,000	10	Oct. 28	—	4½%	Do. 4½ p.c. Pref.	4—6	4½—5½	...
100,000	Stk.	Dec. 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	56 60*	...
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	...	...
1,513,480	,,	July 18	5/9/4	42/8	Commercial 4 p.c. Stk.	106—108	56 62	...
560,000	,,	,,	5½	38/4	Do. 3½ p.c. do.	103—105	55—60	60
475,000	,,	—	5	5%	Do. 3 p.c. Deb. Stk.	69½—71½	43—46*	...
400,000	,,	Dec. 15	4	—	Continental Union Ltd.	76—79	18—20	...
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	111—118	33—38*	...
31,600	,,	Aug. 26	15	15%	Croydon A 10 p.c.	...	160—165	...
278,400	—	,,	12	12%	Croydon B and C 7 p.c.	...	125—130	...
492,270	Stk.	—	6	4½%	Derby Con. Stk.	133—135	...	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	...	...
1,002,180	10	Jan. 29	10	5 /0	European, Ltd.	17½—18	6½—7	6½—6⅞
16,298,975	Stk.	Aug. 11	4/17/4	46 8	Gas Light and Coke { 4 p.c. Ord.	98—102	69—71	69⅜ 70½
2,600,000	,,	,,	3½	35/—	Gas Light and Coke { 3½ p.c. max.	76—79	51—54	51—52½
4,062,235	,,	,,	4	4%	Gas Light and Coke { 4 p.c. Con. Pref.	96—99	65 67	66—66½
4,674,850	,,	Dec. 15	3	3%	Gas Light and Coke { 3 p.c. Con. Deb.	72½—74½	50—5 *	53½
130,000	,,	Dec. 11	10	10%	Gas Light and Coke { 10 p.c. Bonds.	...	...	...
82,500	,,	Sept. 14	5	3½%	Hastings & St. L. 5 p.c.	...	...	...
258,740	,,	,,	3½	2½%	Do. 3½ p.c.	87—89	43—55	...
70,000	10	May 12	11	5%	Hongkong & China, Ltd.	16½—16¾	5—6	...
86,600	Stk.	Aug. 26	9	9%	Hornsey 7 p.c.	...	100—105	...
131,000	,,	July 28	7½	7½%	Ilford A and C	131—134	84—86	85—85½
65,780	,,	,,	6½	5 12%	Do. B	115—118	61—63	...
65,500	,,	Dec. 30	4	4%	Do. 4 p.c. Deb.	92—94	36—38*	...
1,976,000	,,	Oct. 28	9	5%	Imperial Continental	130—160	136—141	137
1,235,000	,,	Aug. 11	3½	3½%	Do. 3½ p.c. Deb. Red.	74—86	78—83	...
1,064,235	,,	Aug 26	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	72—74	73½
2,408,903	,,	Feb. 26	10	37/6	Liverpool 5 p.c. Ord. { A.	211—213	...	...
					Liverpool 5 p.c. Ord. { B.	146—148	...	...
308,083	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	...	...	
165,736	,,	Aug. 11	7/3/6	6%	Maidstone 5 p.c.	...	54—56	
63,480	,,	Dec. 30	—	3%	Do. 5 p.c. Deb.	...	40— 43*	
75,000	5	June 11	6	5%	Malta & Mediterranean	4½—4¾	2—2½	2 1/16
250,000	100	Oct. 3	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	93—100	...
541,930	Stk.	Nov. 30	4	6%	Monte Video, Ltd.	11½—12	53—58	...
1,875,892	,,	July 28	4½	3%	Newcastle & Gateh'd Con.	98½—99½	67—69	...
529,705	,,	Dec. 30	3½	3½%	Do. 3½ p.c. Deb.	82—85	50—52*	...
15,000	10	Aug. 26	—	7/6	North Middlesex 10 p.c.	...	12½—13½	...
55,940	10	,,	7/14/0	5/3	Do. 7 p.c.	14—15	7½—8½	...
300,000	Stk.	Dec. 15	8	8%	Oriental, Ltd.	117—122	84—87*	...
60,000	5	—	10	—	Ottoman, Ltd.	7½—7¾	2—3	...
188,120	Stk.	Dec. 30	—	6%	Plym'th & Stoneh'se 5 p.c.	...	66—68*	...
60,000	50	Aug. 26	13	60/—	Portsea Island, B	128—131	64—67	...
100,000	50	,,	12	55/—	Do. C	118—121	52—54	...
249,980	5	—	8	—	Primitiva Ord.	1½—1¾	½—1	12/6—14/-
499,960	5	—	5	—	Do. 5 p.c. Pref.	4½—5	1 1/16—2 1/16	38/3—40/-
521,600	100	Dec. 1	4	4%	Do. 4 p.c. Deb.	91—95	65—67	...
600,000	Stk.	July 28	4	4%	Do. ,, ,, 1911	...	44 47	...
346,198	,,	Dec. 30	4	4%	River Plate 4 p.c. Deb.	85—87	43—46*	44—45
150,000	10	Sept. 29	6	6/—	San Paulo { 6 p.c. Pref.	10½—11	6—6½	...
125,000	30	Jan. 3	5	5%	San Paulo { 5 p.c. Deb.	47—49	35 —38*	...
135,000	Stk.	Aug. 26	10	5%	Sheffield A	225—234	64 66	...
209,984	,,	,,	10	5%	Do. B	223—234	64—66	...
523,500	,,	,,	10	4 2/9%	Do. C	220—232	64—66	...
133,201	Stk.	Sept. 13	4	4%	Shrewsbury 5 p.c.	...	...	...
90,000	10	Oct. 28	9	8%	South African	10½—11½	7—9	...
2,609,895	Stk.	July 28	5/14/0	5%	South Met. Ord.	111—113	75 77	74½—77
250,000	,,	July 14	—	5%	Do. Red. Pref.	...	93—97	...
1,895,445	,,	,,	3	3%	Do. 3 p.c. Deb.	72½—74½	49—51	...
234,820	,,	Dec. 15	3½	4 1/6%	South Shields Con. Stk.	137—139	86 88*	...
1,082,793	,,	Aug. 11	6	5 5/9%	S'th Suburb'n Ord. 5 p.c.	114—116	72 75	...
368,837	,,	Dec. 30	5	5%	Do. 5 p.c. Deb. Stk.	116—118	72 75*	73½
847,740	,,	Nov. 26	7½	4%	Southampton Ord.	99—102	57 60	...
121,375	,,	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	...	58—60*	...
120,000	,,	Aug. 11	—	6%	Tottenham { A 5 p.c.	135—138	68 72	...
782,275	,,	,,	6	4½%	Tottenham { B 3½ p.c.	115—117	60— 63	...
181,235	,,	Dec. 15	4	4%	Tottenham { 4 p.c. Deb.	87—89	55—58	56—57
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	3—6	1—2	...
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
836,476	Stk.	Aug. 26	5	3½%	Tynemouth 5 p.c. max.	108½—109	63—67	...
30,000	,,	Aug. 11	8½	66/3	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151—156	79—81	...
855,636	,,	,,	6½	51/3	Do. B 3½ p.c.	129—134	60—62	...
108,075	,,	,,	—	46/4½	Do. C	...	57—59	...
140,865	,,	,,	—	46/4½	New Ordinary	...	57—59	...
352,000	,,	,,	6½	45/—	Wimbledon 5 p.c.	117—122	54—56	...
91,000	,,	,,	6½	50/—	Epsom 5 p.c.	121—126	57—59	...
88,416		Dec. 30	5	3½%	5 p.c. Deb. Stk.	66—69	44—47*	...

* Ex Div.

A Reduction at Gorleston.—The price of gas supplied by the Gorleston and Southtown Gas Company has now been reduced by 1½d. per therm to all consumers. This reduction follows closely upon the 1d. per therm reduction which was made at the Michaelmas quarter.

Price of Gas at Plymouth.—The Plymouth and Stonehouse Gas Company have reduced the price of gas by three-fifths of a penny per therm, which is equivalent to about 2½d. per 1000 c.ft. The quality of the gas has also been raised to 450 B.Th.U., being an increase of 25 B.Th.U.

Doncaster's Gas Position.—At the New Year meeting of the Doncaster Town Council, a subject raised was the condition of the town gas supply. Mr. S. Morris (the Chairman of the Gas Committee) said, after what had passed during recent weeks, it was essential something definite should be stated. They wanted the public to realize that, though there was much to complain about, the Committee were alive to the need for improved service. They had had difficulty with regard to coal; but there had also been two or three successive mishaps at the works, and some of the ascension pipes had been blocked owing to the bad coal. The Committee had determined on a full and frank inquiry. He did not go so far as some critics, and say the whole plant needed scrapping; but the Committee would inquire into its efficiency and capacity to meet the need of to-day, after having been working for some 20 or 25 years. They would see why the works were not getting as good coal as formerly. They would shield nobody, from the top to the bottom. The mains had been lain a good many years; and inquiry was to be made as to their efficiency. Much of the faulty lighting of which complaint was made proved to be due to bad house fittings; and the Committee proposed to appoint two or three inspectors to visit consumers. The meeting complimented the Committee on their action; and the minutes were adopted.

Cheaper Gas at Margate.—In announcing that the price of gas per therm at Margate is to be 13·2d., the Secretary of the Isle of Thanet Gas Light and Coke Company (Mr. A. J. Stickels) points out that this represents a substantial reduction in the price of gas, equal to a decrease from 5s. 6d. to approximately 5s. per 1000 c.ft.

Irish Gas Prices.—The Coleraine Urban District Council have rescinded a November resolution reducing the price of gas by 10d. per 1000 c.ft.; and it was decided to make a further reduction of 10d.—a total of 1s. 8d.—to date as from Oct. 1. The price of gas in Newry has from Jan. 1 been reduced from 8s. 4d. to 7s. 11d. per 1000 c.ft.

Craven Arms Gas Supply.—Being unable to find a purchaser, the Craven Arms Gas Company are closing-down their works this week, much to the regret of the people of the district. The railway authorities have had to fit oil-lamps in their offices, signal boxes, platforms, &c., which are very poor compared with the gas. The price of gas in the district was 8s. 6d. per 1000 c.ft., or 8 c.ft. for a penny through the slot meters.

Fatal Explosion at the Turriff Gas-Works.—By an explosion on Monday of last week in the gas-works at Turriff, Aberdeenshire, Alfred Quirie, an employee, lost his life, and the Manager (Mr. Andrew Forbes) was cut about the head and bruised. It appears that in the course of the morning, Quirie, under the superintendence of the Manager, set about the repair, within the works, of a station meter which had not been registering correctly. A part of the meter was unscrewed, when an accumulation of gas became ignited from a jet burning close by. Quirie, who was in close proximity to the meter, was struck by a piece of the ironwork, and his skull was fractured. Mr. Forbes was hurled some distance through the meter-house; but upon recovering consciousness he was able to lend aid to his unfortunate workman, who, however, was so severely hurt that he died within half-an-hour.

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